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EVALUATION OF BUPRENORPHINE AS AN ADJUNCT TO LIGNOCAINE AND BUPIVACAINE MIXTURE IN AXILLARY PERIVASCULAR BLOCK

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ABSTRACT

Introduction: The alleviation of pain is the main concern of anaesthesiologists and has received tremendous focus in this evolving field of medicine. The limitations of local anaesthetics are: slower onset and shorter duration of action. Different adjuncts have been tried to fill the lacunae created by the local anaesthetics. The existence of opioid receptors in peripheral nerve tissue has led to investigation of incorporating small doses of opioids in peripheral nerve blocks, hoping to achieve analgesia with minimal central side effects. Studies have shown that buprenorphine is superior to morphine in postoperative analgesia.

Materials & Methods: A prospective randomised double blind study was conducted on 60 healthy consenting adult patients scheduled for upper extremity surgery. The patients were assigned randomly to either of two groups based on the drugs used for the blocks: Control group (Local Anaesthesia alone) and Intervention group (Local Anaesthesia + buprenorphine). Post operative pain was assessed by Visual Analogue scale and any complication was duly noted. Collected Data was analysed by SPSS ver. 19 using appropriate statistical tests.

Results: Mean age of the study subjects was 42.2 ± 6.1 years. No statistical difference was noted in onset of sensory and motor block. The mean latency of block was 22.96 ± 4.4 and 18.7 ± 3.84 minutes in group I and II and the difference was statistically significant. The duration of post op analgesia was also significantly higher in Intervention group (6 ± 0.9 vs. 15.5 ± 3.4 hours). Mean VAS scores in both groups were compared at 4, 8, 12, 24, 36 and 48 hours. The mean VAS scores were significantly higher in control group till 36 hours.

Conclusions: Addition of buprenorphine decreases the latency of block with early establishment of surgical anaesthesia, improves the quality and duration of post-op analgesia, and also reduces the number of doses required for postoperative analgesia without affecting the duration of motor block and hemodynamic stability.

KEYWORDS: Adjunct, Brachial Plexus Block, Buprenorphine, Local Anaesthesia

INTRODUCTION

The alleviation of pain is the main concern of anaesthesiologists and has received tremendous focus in this evolving field of medicine. Many methods, many drugs and many routes have been tried for this purpose. Fundamental to modern neural blockade is the concept that pain is a sensory warning conveyed by specific nerve fiber, amenable in principle, to modulation or interruption anywhere in the nerve's pathway.

Pain relief after upper limb surgery can be achieved by various regional anaesthetic techniques. The axillary perivascular brachial plexus block is one among the most popular regional nerve blocks performed. The easy and predictable landmarks make it a popular approach. The advantages are –It provides long lasting post operative analgesia, thereby reducing the systemic analgesic requirement; it aids in early ambulation, overcoming the disadvantages of general anaesthesia.

The limitations of local anaesthetics are-slower onset and shorter duration of action. Different adjuncts have been tried to fill the lacunae created by the local anaesthetics. The novel approaches are, alkalinization of local anaesthetics, carbonation, addition of opiates, calcium channel blockers (verapamil), clonidine. The existence of opioid receptors in peripheral nerve tissue has led to investigation of incorporating small doses of opioids in peripheral nerve blocks, hoping to achieve analgesia with minimal central side effects.[1] Hence pain relief using opioids admixed with local anaesthetics for peripheral nerve block has been tried.

Buprenorphine, a semi synthetic thebaine congener is thirty to thirty five times more potent than morphine. It has a longer duration of action due to high affinity to mu receptor. Studies have shown that buprenorphine is superior to morphine in postoperative analgesia.[2-5] All these studies encouraged us to evaluate the effect of Buprenorphine in the mixture of lignocaine with adrenaline and bupevacaine in Axillary perivascular Brachial plexus block.

MATERIALS AND METHODS

A prospective randomised double blind study was conducted at a tertiary care hospital of Nagpur. After approval of the ethical committee, 60 healthy consenting adult patients scheduled for upper extremity surgery were enrolled in the study. Patients were assigned randomly to either of two groups based on the drugs used for the blocks. In both the groups patients were of ASA grade-I and II.

Group I (Control Group) (N-30): Patients received 20 ml 1.5% lignocaine with adrenaline + 20 ml of 0.375% Bupivacaine + 1 ml Normal Saline

Group II (Intervention Group) (N-30): Patients received 20 ml 1.5% lignocaine with adrenaline + 20 ml of 0.375% Bupivacaine + 2µg/Kg Buprenorphine

All the selected patients were given night sedation with tab. Diazepam 10mg HS and Tab. Ranitidine 150mg HS. The technique used for Anaesthesia was Double injection technique of Axillary perivascular block by Burnham[6]; Hudon & Jacques.[7]

Standard monitoring included electrocardiography, manual blood pressue recording and pulse oximetry. Baseline reading of pulse, blood pressure, respiratory rate and SPO_2 were taken. Sensory and Motor blockade were tested by pin prick and finger movement (Hollmen Scale)[8] respectively every 5 minutes. Latency of block was considered as the time from injection of drug till patient had complete loss of sensation and loss of finger movements (Score of 4 in Hollmen Scale). After assessment of block, patient was sedated with IV Midazolam 1-2mg. Standard monitoring of baseline parameters was followed during surgery. Complete vigilance regarding appearance of any complication (like pain, nausea etc.) was observed and appropriate measures were taken intra-operatively.

Post-operatively pulse, blood pressure, respiratory rate and SPO_2 were taken and patient was observed till 48 hours. Post operative pain was assessed by Visual Analogue scale (VAS).[9] VAS score was noted at 0^{th}, 4^{th}, 8^{th}, 12^{th},

24th, 36th and 48th hour. Rescue analgesia by Injection Diclofenac sodium 75 mg IM was given if VAS score was 5 or more. Any post-operative complication was also noted.

The study was kept double-blind by having 1 anesthesiologist prepare the solutions, a second anesthesiologist performs the blocks and third anesthesiologists monitor the anesthesia and analgesia thereafter, up to and including the time of the first request for an analgesic medication. All the collected data was entered in Microsoft Excel 2007 and then Transferred to statistical software. Data analysis was done using SPSS statistical software Ver. 19 by applying appropriate tests. P value of < 0.05 was considered to be statistically significant. Categorical variables were compared using chi-square tests, continuous variables using unpaired t test and fischer exact test for small numbers.

RESULTS

In the present study 60 patients with age between 18 to 50 years (Mean - 42.2 ± 6.1 years), undergoing orthopaedic or plastic surgeries requiring axillary perivascular block were included.

Table 1 shows the comparison of various pre and post operative parameters between the two groups. The Mean duration of surgery was 109.7 ± 31.5 and 110.2 ± 39.9 minutes in group I (Control group) and II (Intervention group) respectively. No statistical difference was noted in onset of sensory and motor block. The mean latency of block was 22.96 ± 4.4 and 18.7 ± 3.84 minutes in group I and II and the difference was statistically significant. The duration of post op analgesia was also significantly higher in Intervention group (6 ± 0.9 vs. 15.5 ± 3.4 hours).

Mean VAS scores in control and intervention group were compared at 4, 8, 12, 24, 36 and 48 hours. The mean scores were significantly higher in control group till 36 hours table 2.

Table 3 compares the intra-operative complications and post-op side effects between the groups. Torniquet pain was more common in control group. Side-effects like nausea/vomiting, pruritis, bradycardia, drowsiness and urinary retention in intraoperative and postoperative period can be attributed to systemic absorption of Buprenorphine. These side effects were minor and easily treatable. The mean number of doses required for postoperative analgesia was reduced to almost half in intervention group which was statistically significant ($p<0.01$). Thus the patients in intervention group were more comfortable and had less pain in postoperative period table 4.

DISCUSSIONS

Axillary brachial plexus is a simple, safe and easy technique. It provides anesthesia to the patients undergoing ambulatory upper extremity surgery. Regional anesthesia provides preemptive as well as postoperative analgesia. Adding opioids to the local anesthetic drug in brachial plexus block improves quality and duration of block as well as duration of postoperative analgesia. This prospective, randomized, double blind study was done in 60 patients scheduled for upper limb surgery under axillary perivascular brachial plexus block.

Buprenorphine-local anesthetic perivascular brachial plexus block provided postoperative analgesia lasting almost three times longer than local anesthetic block alone. This supports the concept of peripherally mediated opioid analgesia by Buprenorphine.[4] The addition of buprenorphine to the local anesthetic used for brachial plexus block in the present study provided increase in the duration of postoperative analgesia, with complete analgesia persisting 7-9 hours beyond the duration provided by the local anesthetic alone in most of the patients. This practice can be of particular benefit to patients undergoing ambulatory upper extremity surgery by providing prolonged analgesia after discharge from the hospital.[5]

In our study the mean duration of satisfactory analgesia with buprenorphine was 15.5 ± 3.4 hours is similar as reported in other studies (14-34 hrs.).[3-5] Bazin et al [3] reported sustained analgesic effect from opioids used in supraclavicular block which outlasted the local anaesthetic action of bupivacaine. The adjuncts used were morphine 75mcg/kg, buprenorphine 3mcg/kg or sufentanil 0.2mcg/kg. Patients reported prolonged satisfactory analgesia with Buprenorphine (median 20 h, range 14-34), morphine (median 21 hrs, range 9-27) and sufentanil (median 24.5 hrs, range 8-48) compared with saline (median 11.5 hrs, range 8-15). They demonstrated prolonged satisfactory analgesia after addition of opioids to local anaesthetic.

Ortells Polo et al[6] in their study of modified supraclavicular perivascular block recorded an onset time of 4.9+ 0.2 minutes and the time for motor paralysis at 15.2+ 6.9 minutes. This study support our data i.e. in Group I the onset time for motor block was 4.1 ± 0.9 min. and sensory block was 6.5 ± 1.2 min. Group-II the onset time for motor block was 3.7 ± 1.2 min. and sensory block was 4.3 ± 1.3 min.

Opioids have long been thought to act exclusively within the central nervous system. An increasing number of studies recently reported the existence of opioid receptors outside the central nervous system and therefore suggested that opioids are also able to produce analgesic effects in the periphery.[10] Experimental studies have shown that perineural Buprenorphine could produce two types of effect on neuronal excitability (Boogaerts J, Lafont N et al)[12]. The first one is a local anesthetic action on the nerve fiber with a diminution of sodium and potassium conductance. The second is due to a linkage of the opioid with a receptor on the internal face of the membrane.

Opioids could also migrate to the posterior horn of the spinal cord after linkage with axonal receptors. These findings expand the gate control theory of pain and suggest new approaches such as the development of peripherally acting opioid analgesics without central side-effects.[11] Through its direct effect on Substantia gelatinosa, Buprenorphine disrupts the normal process of pain, interferes with facilitation, amplification and summation. No serious complications related to block technique or addition of buprenorphine were observed in present study.

Clinical studies have proved that opioid injection in the brachial plexus produce a prolonged analgesia in the postoperative period. The more liposoluble opioids like fentanyl and buprenorphine are the more effective.[12] Our study and other studies [2-5] have shown that addition of buprenorphine to local anaesthetic increase the postoperative analgesia to a great extent, however the controversy still exist. Trials of a higher quality are needed to provide a definitive answer.[13]

CONCLUSIONS

Results of this study shows that addition of buprenorphine to bupivacaine mixture for perivascular brachial plexus block decreases the latency of block with early establishment of surgical anaesthesia, improves the quality and duration of post-op analgesia and also reduces the number of doses required for postoperative analgesia without affecting the duration of motor block and hemodynamic stability.

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APPENDICES

Table 1: Comparison of Various Pre and Post Operative Parameters between the Groups

Parameters (N-30)	Group	Mean	SD	P-Value
Duration of Surgery (Min.)	I	109.7	31.5	0.95
	II	110.2	39.9	
Onset of Sensory Block (Min.)	I	6.5	1.2	0.41
	II	4.3	1.3	
Onset of Motor Block (Min.)	I	4.1	0.9	0.15
	II	3.7	1.2	
Latency of block (Mins.)	I	22.9	4.4	< 0.01
	II	18.3	3.8	
Duration of Motor Block (Hrs.)	I	5.2	0.6	0.28
	II	5.5	0.9	
Duration of Sensory Block/ Post-op Analgesia (Hrs.)	I	6.0	0.9	< 0.01
	II	15.5	3.4	

Table 2: Comparison of VAS Scores between the Groups (N-30)

Group	4 Hrs	8 Hrs	12 Hrs	24 Hrs	36 Hrs	48 Hrs
I	2.7 ± 1.1	3.1 ± 1.2	3.4 ± 1.1	3.9 ± 0.9	3.8 ± 1.1	3.5 ± 1.1
II	1.2 ± 0.8	1.4 ± 1.8	1.8 ± 0.8	3.5 ± 0.8	3.4 ± 1.1	3.2 ± 0.8
P- value	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06

Table 3: Comparison of Intra and Post-Op Complications between the Groups

Intra-Op Complication (N-30)	Group I	Group II
Arterial Puncture	4 (13.3%)	2 (6.7%)
Torniquet Pain	3 (10%)	1 (3.3%)
Nausea/ Vomiting	0	2 (6.7%)
Pruritis	0	1 (3.3%)
Hypotension	0	0
Bradycardia	0	1 (3.3%)
Post-Op Side Effects (N-30)		
Nausea/ Vomiting	0	1 (3.3%)
Drowsines	0	4 (13.3%)
Bradycardia	0	0
Hypotension	0	0
Urinary retention	0	1 (3.3%)

Table 4

Group	No. of Analgesic Doses in Postoperative Period (Mean ± SD)	P - Value
I	4 ± 0.83	P < 0.001
II	2.14 ± 0.74	