COMPARISON OF EFFICACY OF ROPIVACINE ALONE WITH TRAMADOL – ROPIVACAINE COMBINATION IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERY

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ABSTRACT

Background and Objectives: Repivacaine, a long acting local anaesthetic, less toxic than bupivacaine is now being used in peripheral nerve blocks. Most commonly adjuvants are used to enhance the quality and duration of anaesthesia and analgesia. The objective of this study was to compare the effect of tramadol as adjuvant to ropivacaine on the quality, duration of anaesthesia and postoperative analgesia in supraclavicular brachial plexus block.

Methods: A total of 60 patients of 25 – 60 years were randomly assigned into two groups of 30 each. Group I was given 0.5% Ropivacaine 28 ml with the addition of 2 ml saline. Group II was given the same amount of 0.5% Ropivacaine with the addition of 2 ml Tramadol (100 mg). After aseptic measures supravlavicular bracnial plexus block was administered and study drug was injected. Sensory and motor block were assessed at 5, 10, 15, 20 and 25 monitored at 1, 2, 4, 8 and 12 hours. The first request analgesia time was noted.

Results: The onset of sensory and motor block was not different in both groups. The duration of sensory and motor block were significantly prolonged in Group II. Pain scores were lower in Group II but there was no significant difference.

Conclusion: Tramadol when used as an additive with ropivacaine provides better anaesthesia and analgesia in peripheral nerve block.

Keywords: Supravlacivular brachial plexus, tramadol, ropivacaine, sensory, motor.

INTRODUCTION

Supraclvicular brachial plexus block is a preferred and safe technique for providing rapid and reliable anaesthesia in upper extremity surgery that does not involve shoulder.[1,2] It has the advantage of minimizing intraoperative haemodynamic changes and providing postoperative pain relief thus promoting early recovery and discharge.[3] In peripheral nerve blocks, bupivacaine is used frequently due to its prolong duration of action.[4] Ropivacaine the S-enantiomer of N-2, 6-dimethylphenyl-1-propyl-2 piperidinecarboxamide is a new long-acting local anaesthetic which produces less cardiac and central nervous system toxicity than bupivacaine.[4,5,6] Several additives have been used in combination with local anaesthetics for peripheral nerve blocks, including opioids, clonidine, dexamethasone, dexmedetomidine, midazolam to enhance the quality, duration of anaesthesia and postoperative analgesia.[7,8] The addition of opioids such as meperidine, fentanyl and morphine have provided effective and long lasting anaesthesia and analgesia.[2] Tramadol, a synthetic 4-phenyl-piperidine analog of codeine with its mu-receptor agonistic activity has central analgesic effects and also has peripheral local anesthetic properties that led to its use as an adjunct in peripheral nerve blocks.[9] Various studies have been done with different drugs but few are seen with tramadol-ropivacaine combination in Pakistani population.

The purpose of this study was to compare the effects of tramadol – ropivacaine combination on onset, quality, duration of anaesthesia and postoperative analgesia with ropivacaine plain in supraclavicular brachial plexus block for upper limb surgery.

METHODOLOGY

This double blinded randomized controlled study was approved by the Department of Anaesthesia and Institutional Review Board of King Edward Medical University and Allied Hospitals, Lahore – Pakistan. Sixty patients aged 25 – 60 years, ASA I & II status scheduled for upper limb surgery were enrolled after written informed consent. Patients with haemodynamic instability, arrhythmias, coagulopathy, skin infection at site of incision, hypersensitive to study drugs and patients with neuromuscular disorders were excluded from the study. Patients were assigned randomly into two groups of 30 each by using a sealed envelope technique that was randomly selected and opened at the time

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when patient presented. Group I was given 0.5% Ropivacaine 28 ml with the addition of 2ml saline. Group II was given the same amount of 0.5% Ropivacaine with the addition of 2 ml Tramadol (100 mg). Drugs were prepared by a person who did not perform the block and blinding was done by using similar syringes.

Details of the anaesthetic technique were fully explained to the patients. On arrival in the theatre, 20 – guage intravenous cannula was inserted into the opposite dorsal hand. Routine monitoring of electrocardiography, heart rate, pulse oximetry, non-invasive blood pressure measurements were conducted. 0.03 mg/kg midazolam was given to relieve anxiety and major discomfort keeping in Ramsay Sedation Scale of 2.

Each patient was placed supine with the head turned to the opposite side and ipsilateral arm adducted. The interscalene groove and pulsation of subclavian artery above the midpoint of the clavicle posterior to midpoint of clavicular head of sternocleidomastoid were identified. After aseptic preparation of the area about 1 – 2 cm above the clavicle posterior to subclavian pulsation, subcutaneous infiltration was done with 1ml of 2% lignocaine. A 22 – guage short bevelled insulated needle connected to a nerve stimulator was inserted at this point to locate the plexus. A current of 1.5mA was set to elicit the movement of hand. The 30 ml of prepared study drug was injected when the response of hand was visible with a current of 0.5mA. After injection, patients were assessed for sensory block with use of a pinprick from C3 to T1 and graded according to 3 point rating scale. A score of < 2 was considered incomplete (Table 1).[10,11] The sensory tests were conducted at 5, 10, 15, 20 and 25 minutes. Sensory block was considered successful if it occurred in 25 min. The time of onset and duration of sensory block was recorded. The time from onset till the return of pinprick sensation was considered duration of sensory block.

Motor block was evaluated by movement of hand and graded according to 3 point scale. A score of 2 was considered to be a complete block.[10-12] Time to onset and duration of motor block were recorded. Duration of motor block was taken as the time from the onset to the recovery of movement of hand.

The degree of pain was assessed by verbal rating scale on a 5 point rating. Patients reporting VRS of 2 were given 0.5 mg/kg of nalbuphine intravenously. General anaesthesia was induced in patients with VRS more than 2 and inadequate surgical conditions.[13] (Table 2).

The effectiveness of block for surgical anaesthesia was rated as successful (patient expressing no discomfort throughout the procedure), adequate (mild discomfort treated with narcotic) and inadequate (required general anaesthesia or ketamine).[4,14]

In the intraoperative period heart rate, blood pressure, oxygen saturation were monitored in both groups every 15 min till end of surgery. Adverse effects such as nausea, vomiting, dizziness and respiratory depression were also recorded. Assessment of postoperative pain was done at 1, 2, 4, 8 and 12 hours and time of first request for analgesia was noted.

Data Analysis

Demographic data was expressed as mean ± SD. Data analysis was done using SPSS 15.Haemodynamic parameters were analysed with repeated measures of ANOVA. Quantitative variables were analysed with Mann Whitney U test and qualitative variables were analysed by Chi square. $P < 0.05$ was taken as significant. First request for analgesia time was analysed by Independent sample t-test. Sample size was calculated taking effect size 0.5, with confidence interval of 95%, alpha 0.05 and 80% power of study.

RESULTS

Sixty patients were included in the study who were similar in age and weight expressed as mean ± SD. Sex is expressed as Male/Female ratio (Table 3).

The onset of sensory and motor block did not show significant difference between groups (Table 4). The duration of sensory and motor block was significantly prolonged in Group II ($p = 0.01$ and $p = 0.004$). After achieving a successful block, pain scores were lower in Group II but the difference was not significant. (Table 5) Heart rate, blood pressure remained stable in both groups during surgery with no significant

Table 1: *Extent of Sensory and Motor Block.*

Sensory Block Response to pinprick			*Motor Block Movement of hand*		
Normal	Blunted	Absent	Normal	Decreased	Absent
0	1	2	0	1	2

Table 2: *Pain Score by Verbal Rating Scale.*

No Pain	*Mild*	*Moderate*	*Severe*	*Unbearable*
0	1	2	3	4

Table 3: *Demographic Data, Mean ± SD.*

	Group I	*Group II*
Age (years)	41.97 ± 11.14	38.80 ± 11.93
Weight (kg)	69.57 ± 6.22	67.60 ± 8.27
M/F ratio	27/3	26/4

Table 4: *Characteristics of Sensory and Motor Blocks.*

	Group I	*Group II*	*P-value*
Sensory Block			
Onset (min)	10.93±2.90	9.40±2.22	0.10
Duration (hours)	3.9±2.05	5.27±2.01	0.01
Motor Block			
Onset (min)	13.65±2.17	13.15±3.64	0.20
Duration (hours)	3.19±0.69	4.38±1.57	0.004

Table 5: *VRS and First Request Analgesia Time. Mean ± Sd.*

	Group I	*Group II*	*P-value*
VRS at beginning of surgery	0.57 ± 0.72	0.37 ± 0.66	0.17
First Request Analgesia Time (hours)	5.4 ± 2.83	7.00 ± 2.77	0.03

Table 6: *Postoperative VRS Scores.*

Time after Surgery	*Group I*	*Group II*
1 hour	0.45 ± 0.91	0.13 ± 0.34
2 hour	0.2 ± 0.50	0.40 ± 0.96
4 hours	1,08 ± 0.97	0.31 ± 0.73
8 hours	1.40 ± 0.843	1.18 ± 0.95
12 hours	2.00 ± 0.00	2.00 ± 0.00

Table 7: *Adverse effects seen during study.*

	Group I	*Group II*
Nausea / Vomiting	0	1
Respiratory depression	0	0
Bradycardia	0	0
Hypotension	0	0

difference. Successful block was achieved in 86% patients in group II in comparison of 68% in group I. (p = 0.01) General anaesthesia had to be given to 4 patients (13%) in each group due to failure of block. Injection nalbuphine was given to 6 patients in group I with mild discomfort while no narcotic had to be given in group II during surgery. Postoperatively, lower pain scores were observed in group II (87%) in comparison to group I (74%) during 1, 2, 4 and 7 hours (Table 6). The mean time to first request for analgesia was 7.00 ± 2.77 hours in Group II as compared to 5.40 ± 2.83 hours in Group I. This was statistically significant difference (p = 0.03). No adverse events were encountered in either group except only one patient complained of nausea in group II (Table 7).

DISCUSSION

Regional anaesthetic techniques are becoming increasingly popular in orthopaedic surgery giving the advantage of better postoperative pain relief, early mobility and the avoidance of risks and side effects of general anaesthesia.[10] Supraclavicular brachial plexus block was first described by Kulenkampf in 1911. Recently this approach has gained importance in providing surgical anaesthesia. It not only avoids the stress response to laryngoscopy and intubation but also evades the adverse effects of drugs used in general anaesthesia.[8,15] It also provides a homogenous block of the upper extremity without sparing the musculocutaneous and ulnar nerves.

Local anaesthetics often used in peripheral nerve blocks, provide surgical anaesthesia and postoperative analgesia by blocking signals to the dorsal horn. A lot of research has been done to determine the ideal drug or combination. An ideal drug would be the one with a fast onset of action and longer duration with minimum side effects while providing prolonged analgesia. Bupivacaine is the most frequently used anaesthetic due to its prolong duration of action. Ropivacaine, (S entaniomeramino-amide) local anesthetic, chemically similar to bupivacaine, is being used at present because of its less cardiac and central nervous system toxicity.[4]

Combinations of local anaesthetics have been used to enhance the onset of sensory and motor block.[4] Certain drugs may be used as adjuvants to local anaesthetics to lower the dose of each agent, to enhance the quality and duration of block, to increase the analgesic effect and reducing the need for supplementary analgesics thus decreasing the incidence of adverse reactions. Tramadol and fentanyl have been successfully used as adjuvants earlier.[11]

Tramadol is a synthetic opioid selective for mu receptors. Its' monoaminergic activity inhibits nociceptive transmission by augmenting the inhibitory activity of descending pain pathways.[9] Several studies have suggested that tramadol has peripheral local anaesthetic effects with minimal sedation and no cardiovascular compromise.[16] The mechanism of action is similar to lignocaine causing an axonal block by acting on voltage – dependent sodium channels, thus altering the sensory and motor nerve conduction.[17]

The comparison of combination of ropivacaine – tramadol with ropivacaine in this study did not show significant difference in the onset of sensory and motor block among groups (Table 4). But the duration of sensory and motor block was significantly prolonged in ropivacaine – tramadol group (p = 0.004). Lower pain scores were seen in ropivacaine-tramadol group after a successful block before the beginning of surgery but

the difference was not significant. Haemodynamically patients remained stable in both groups during surgery with no significant difference. A successful block was achieved in 86% patients in group II in comparison of 68% in group I. (p = 0.01) Postoperatively, lower pain scores were seen in ropivacaine – tramadol group (87%) but the difference was not significant. The first request analgesic time postoperatively, was significantly longer in group II as compared to group I (p = 0.03)

The results of our study are comparable with Ravi Madhusudhana, who found significantly prolonged duration in sensory and motor block and better VAS scores with addition of tramadol as compared to ropivacaine alone in supraclavicular brachial plexus block. The haemodynamics remained stable in all groups.[2]

Similar results were concluded by Sarihasan et al. that when 100 mg tramadol used as an adjuvant to bupivacaine in supraclavicular brachial plexus block improved the quality of anesthesia and prolonged analgesia postoperatively.[18]

Likewise, Geze et al compared tramadol and fentanyl as adjuvants to local anesthetic mixtures in axillary plexus block and found tramadol to be superior in providing better quality of block and postoperative analgesia for orthopaedic upper extremity surgery.[11] Shrestha et al compared dexamethasone and tramadol as admixtures to bupivacaine in supraclavicular brachial plexus block and observed an increase in postoperative analgesia when tramadol was added to bupivacaine. However, it was noticed that dexamethasone showed greater benefit.[7]

Previous reports support the value of tramadol as additive to local anaesthetic in improving the duration and quality of anaesthesia and postoperative analgesia in peripheral nerve blocks. Antonucci showed that tramadol when added to ropivacaine 7.5 mg/ml in axillary plexus block reduces onset time, improves quality of block and prolongs the anaesthesia and postoperative analgesia with a decreased incidence of side effects.[19] Kapral et al. reported that adding tramadol 100 mg to mepivacaine 1% prolonged the duration of both motor and sensory blocks in axillary brachial plexus block.[20] Robaux et al. demonstrated that the duration and quality of analgesia postoperatively was enhanced in a dose dependent manner with the addition of tramadol to 1.5% mepivacainein axillary brachial plexus block. Ahmet et al compared the addition of tramadol and ketamine to ropivacaine in axillary brachial plexus block and concluded that 50 mg, tramadol added to ropivacaine extends the onset and duration of the block and improves the quality of postoperative analgesia.[21]

Few studies have shown conflicting results which could be attributed to the choice of local anaesthetic, administration site of brachial plexus block and patient selection. Dikmen et al did not see significant difference in onset, duration of sensory and motor block when tramadol was added to ropivacaine in axillary plexus block in uraemic patients. The reason may be due to acidosis and hyperdynamic circulatory status of patients with chronic renal failure. This increases the elimination rate of local anesthetics resulting in a shorter duration of the axillary block compared to those with normal and mask the effects of tramadol.[12]

Sarsu et al, performed axillary block by adding tramadol (100 mg) to mixture of levobupivacaine and lidocaine. They reported that the duration of sensory and motor block, time of onset and duration of analgesia was not affected by tramadol.[22] This difference in results could be due to the choice of local anaesthetic mixed with tramadol. We used ropivacaine in comparison to the mixture of levobupivacaine and lignocaine.

Skillful administration of brachial plexus is essential for effective surgical anaesthesia and analgesia. It not only eliminates stress response to surgery but helps in smooth transition of patient from surgery to routine preoperative state. High satisfaction scores were reported by patients in both groups of our study. All were contended with the brachial plexus anaesthesia and overall level of analgesia. The ropivacaine – tramadol group showed significant prolonged sensory and motor block and better pain relief. While the first request analgesia time measured was prolonged in ropivacaine – tramadol group, we did not measure the total amount of supplemental analgesics taken postoperatively. Further studies can be done to observe the efficacy of different doses of tramadol in various combinations of local anaesthetics in our population.

In ***conclusion***, tramadol when used as adjuvant with local anaesthetic inperipheral nerve block provides better surgical anaesthesia and analgesia. Therefore, its use should be promoted for routine addition to local anaesthetics in peripheral nerve blocks.

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