ORIGINAL ARTICLE

Effectiveness of Lignocaine Tramadol Hydrochloride Combination in Bier's Block on Post-Operative Analgesia

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Abstract

Background: Bier's block has been most commonly used for hand and wrist surgery. Though it reduces the potential complication of general anaesthesia, significant post-operative pain is very common just after tourniquet release. Many adjuvants have been used so far with local anaesthetic to produce a dense block and to provide adequate post–operative analgesia. Of them, Tramadol Hydrochloride was used very successfully as it has got less potential side effects. This study was done to see the effect of Tramadol Hydrochloride in Bier's block for post-operative analgesia after tourniquet release.

Methods: This study was carried out in the Department of Anaesthesiology, Bangladesh Medical College Hospital, Dhaka, during the period of July '2011 to march '2012. A total sixty patients aged 20-60 years of ASA-1 and ASA-2 undergoing hand and wrist surgery of less than 40-minute duration were enrolled for the study. The effectiveness of combination of Lignocaine and Tramadol Hydrochloride as an anaesthetic solution in Bier's block was assessed in terms of reduction of tourniquet pain, quality of anaesthesia, the time of first analgesic demand, and the amount of total analgesic needed in post-operative 24-hours period. Patients in control group (Gr-L) received 40 ml of 0.5% Lignocaine and patients in trial group (Gr-LT) received 38 ml of Lignocaine with 2ml (100mg) of Tramadol Hydrochloride as an anaesthetic solution. Patients were observed post-operatively for 24 hours. Pain was assessed in terms of VAS.

Results: Tourniquet pain was significantly less in Gr-LT ($p<0.000$). Post-operative analgesia was also significantly prolonged in Gr-LT (109.61±12.32 min) than in Gr-L (75.8±9.30 min). The number of total analgesic demand in post-operative 24 hours period was also significantly reduced in Gr-LT ($P<0.000$).

Conclusion: The Lignocaine and Tramadol Hydrochloride mixture in Bier's block provides adequate post-operative analgesia and causes less analgesic demand in post-operative period.

Keywords: Bier's block, Tourniquet pain, Post-operative analgesia, Lignocaine, Tramadol hydrochloride, Visual analogue scale (VAS)

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Introduction

Bier's block also known as Intravenous Regional Anaesthesia (IVRA) has been commonly used for surgical procedures of short duration involving the hand and wrist[1]. Although this technique avoids the potential complications of General Anaesthesia, it can result in significant post-operative pain. The use of Lignocaine for IVRA or Bier's block has been the mainstay for controlling peri-operative pain but it provides little or no benefit for post-operative pain[2].

Post-operative pain as a result of Bier's block is due to a combination of neuropathic and inflammatory pain which might be attributed to transaction of cutaneous nerves, disruption of tissues and possible ischaemia at the site of tourniquet. As a result, nociceptive impulses lead to prolonged and widespread excitability in the spinal cord instigating central sensitization. Unfortunately, NSAIDs and muscle relaxants have not demonstrated effective control of central sensitization. Thus, post-operative pain remains a significant complication in forearm and hand surgery patients[3,4].

Tramadol Hydrochloride, the synthetic opioid analgesic can be used to treat these types of pain. It is a centrally acting analgesic that relieves pain by the mechanisms of opioids as well as additional mechanisms. Firstly, it has agonist activity at the μ (mu) and κ (kappa) receptors. Secondly, it enhances the descending inhibitory systems in the spinal cord by inhibiting noradrenaline reuptake and releasing serotonin from nerve ending[5]. It has a duration of action of about 3-6 hours. So, when it is used with Lignocaine in Bier's block, it can shorten the onset of sensory block, enhance the tourniquet tolerance and improve the peri- operative analgesia[6].

In several studies, various adjuvants were mixed to local anaesthetic solutions to provide post-operative analgesia. In this context- NSAIDs, Opioids, Muscle relaxants etc. have been used[7]. During IVRA, the hand and forearm are isolated from the rest of the body. Some leakage of drug into the general circulation can occur when injected distal to the tourniquet. The principle site of anaesthesia was debated[8]. Tourniquet ischaemia alone will produce anaesthesia[9] but a considerably slow rate than in combination with local anaesthetic agents. Local anaesthetic agents probably act at two sites, anaesthetizing both large sheathed nerves at the elbow and also affecting small unsheathed nerve peripherally[10].

Clinical use of opioid analgesic is based on the principle of their dose-response relationship. Increased doses lead to a more frequent incidence of side effects without significant prolongation of post-operative analgesia. It is also recommended that the use of 50 mg Tramadol Hydrochloride in IVRA as an effective pre-emptive and post- operative analgesia free of side effects[11].

Iurie Acalovschi et al[11] studied that the dose of 100 mg Tramadol Hydrochloride would be sufficient for IVRA. It might modify the action of local anaesthetics, providing a shorter onset time of sensory block[6] and the recovery of touch sensation was prolonged.

Ruben et al[12] used Pethidine in Bier's block. They used 75 mg pethidine but even this large dose failed to block conduction in median nerve. Also large dose lead to a more frequent incidence of side effects without significant prolongation of post-operative analgesia. With pethidine, there were unexpected adverse clinical effects such as severe skin vasodilatation, associated with pruritis.

In another study, Abdullah and Fadhil obtained successful analgesia in 100% of cases with combination of Lignocaine (100mg) + Fentanyl (50 mcg) + Pancuronium(0.5 mg). Although they obtained better loss of motor power, however, no improvement in post-operative analgesia was found[13,14]. Cherish Paul studied that the addition of Tramadol(50 mg) fastens the onset of motor block than pethidine (30 mg) & the duration of post-operative analgesia was significantly improved by both Pethidine & Tramadol[15].

Administration of Tramadol Hydrochloride to an isolated extremity would be expected to produce more intense analgesia in that extremities that would occur when the same dose was given systemically. This study compared the effectiveness of combination of Lignocaine and Tramadol Hydrochloride in post-operative analgesia while using Lignocaine alone in Bier's block.

Methods

This prospective randomized controlled study was conducted in the Department of Anaesthesiology, Bangladesh Medical College Hospital, Dhaka, during the period of July '2011 to March '2012. Patients of both sex who are mentally stable & able to understand the procedure, aging 20-60 years, scheduled for minor hand surgery & short Orthopaedic & Neuro-surgical procedure of the forearm & wrist less than one hour duration, ASA grading 1 & 2 were included in this trial. Informed written consent was obtained from all participants.

All the sixty patients undergoing surgery under Bier's block were randomized into two groups: Group-L receiving Bier's block using Lignocaine alone and Group-LT receiving Lignocaine & Tramadol Hydrochloride (100 mg). A total of 40 ml solution was injected in each group.

Pre-anaesthetic check-up was done for each patient on the day before surgery. Each patient was kept fasting for at least 6-8 hours pre-operatively. After taking informed consent in the special consent form for the study, each patient was entered into the operation theatre. Two intravenous cannula were inserted on the dorsal metacarpal vein of both hand. All equipments were checked for leaks & malfunction and all resuscitative drugs & equipments including anaesthesia machine were kept ready. The hand, on which surgery was done, elevated for 5 minutes. Exsanguination was done by means of Esmarch bandage to reduce the venous pressure. An orthopedic tourniquet of the correct size was applied over padding on the upper arm. The tourniquet was inflated to a pressure of 100 mmHg above the patient's systolic pressure. Then the proposed drug for each group for Bier's block were injected through the intravenous cannula over 2-3 minutes. Full monitoring according to the data-sheet was performed. The tourniquet was released after 30 minutes.

The patient was sent into post-operative ward and was observed for 24 hours. Pain was assessed by VAS. The time of need of first analgesic after the Bier's block and the need for total post-operative analgesic drug in 24 hours, were noted in the data sheet.

All statistical analysis was carried out using SPSS statistical package. All results were expressed as mean± SD or in frequencies as applicable. The results were compiled and analyzed using student't' test, chi square and ANOVA as appropriate. Results were considered significant if 'p' <0.05 (confidence interval; CI-95%).

Results

Observation of the present study was analyzed in the light of comparison among the subject groups (Gr-L, Gr-LT) each group having n=30. The studied groups became statistically matched for Age (p<0.738), Sex (p<0.301), Weight (p<0.142) (Table-I), ASA physical status (p<0.488) **(Table-I)**.

The mean (±SD) age of the study patients was

Table I: Demographic profile of the study subjects

	Group L (n=30)		Group LT (n=30)		t value	P value
Age (years)	44.96 ±3.68		45.33 ±4.7		0.113	0.738
Weight (kg)	60.66 ±3.32		59.13 ±3.08		2.219	0.142
ASA grade						
Grade I	24	(80%)	26	(86.7%)	0.480	0.488
Grade II	6	(20%)	4	(13.3%)		
Sex						
Male	14	(46.7%)	18	(60%)	1.071	0.301
Female	16	(53.3%)	12	(40%)		

Group L: 200 mg lignocaine, Group LT: 200 mg lignocaine with tramadol 100 mg. P value reached from unpaired't' test and chi-square test

44.96±3.68 years in group L and 45.33±4.7 years in group LT. The mean (±SD) weight of the study patients was 60.66±3.32 kg in group L and 59.13±3.08 kg in group LT. The male patients were 14 (46.7%) and females were 16 (53.3%) in group L. In group LT male patients were 18(60%) and females were 12 (40%) and the difference was not statistically significant (P>0.05).

The nature of surgery was hand 11(36.7%), wrist 12(40%) and forearm 6(20%) in group L. In group LT, hand 11 (36.7%), wrist 15(50%) and forearm 4 (13.3%) and the difference was not statistically significant (P>0.05). **(Table II)**

Table II: Type of surgery

Type of surgery	Group L (n=30)		Group LT (n=30)		t value	P value
Hand	11	(36.7%)	11	(36.7%)		
Wrist	13	(43.3%)	15	(50%)	0.543	0.762
Forearm	6	(20%)	4	(13.3%)		
Total	30	(100%)	30	(100%)		

P value reached from unpaired‘t’ test and chi-square test

The starting time of tourniquet pain 18 (60%) and 9 (30%) were found between 25-35 minutes group L and group LT respectively out of which 8 (44.4%) has mild pain & 10 (55.6%) had moderate pain in group L whereas in group LT 7 (77.8%) had mild pain and 2 (22.2%) had moderate pain. The mean pain score was 1.47± 0.51 in Group L and 1.11±0.33 in Group LT and the difference was statistically significant. During 36-45 minutes, 9 (10%) and 21 (70%) had tourniquet pain in Group L & Group LT respectively out of which 3(10%) had mild pain and 7(70%) had moderate pain in group L whereas in group LT 15 (71.4%) had mild pain and 6 (28.6%) had moderate pain. The mean pain score was 1.78±0.44 in group L and 1.32 ± 0.48 in group LT and the difference was statistically significant. During 46-55 minutes, 2 (6.7%) and 0(0.00%) had tourniquet pain in group L and group LT respectively out of which 2 (6.7%) had moderate pain only in group L. The mean pain score was 2.0±0.24 in group L. The mean (± SD) starting time of tourniquet pain was 33.4± 6.2 minute range from 25 to 46 minutes in group L and 36.6± 5.6 minutes range from 30 to 55 minutes in group LT. **(Table III)**

The mean duration of first analgesic demand was 75.8± 9.30 minutes in Group L and 109.61± 12.32 minutes in Group LT. The mean difference was significantly ($p<0.05$) higher in group LT with compared to group L. **(Fig. 1)**

Table III: Comparison of tourniquet pain severity between two groups

Tourniquet pain (min)	Group L (n=30) Mean	%	Group LT (n=30) Mean	±SD	t value	P value
25-35 min						
Mild pain	8	44.4	7	77.8	2.700	0.100
Moderate pain	10	55.6	2	22.2		
Mean± SD	1.47±0.51		1.11	±0.33	5.18	0.005
36-45 min						
Mild pain	3	30	15	71.4	4.775	0.029
Moderate pain	7	70	6	28.6		
Mean± SD	1.78±0.44		1.32	±0.48	3.25	0.038
46-55 min						
Mild pain	0		0			
Moderate pain	2	6.7	0			
Mean± SD	2.0±0.24					

P value reached from unpaired‘t’ test and chi-square test

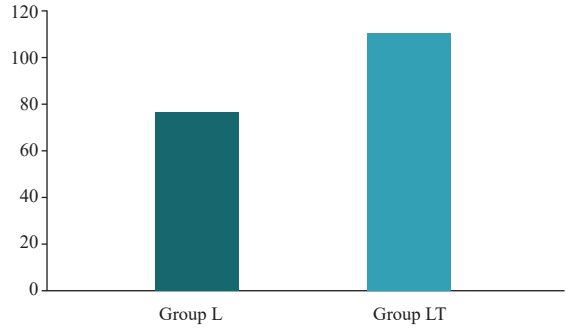

Fig. 1: First analgesic demand (min) in perioperative period

Post-operative analgesia in group L and group LT lasted approximately 5 and 10 hours, respectively. In group LT, analgesics are required significantly less with respect to time to first analgesic and total analgesic in twenty-four hours.

Discussion

Lignocaine 0.5% (3 mg/kg) remains the local anaesthetic of choice for IVRA because of its lower potential of systemic toxicity. In spite of its longer duration of action, bupivacaine is not recommended for IVRA because of its cardiovascular toxicity. Ropivacaine is a new long acting amide local anaesthetic with physiochemical properties similar to those of bupivacaine. Unlike bupivacaine, ropivacaine may have a lower potential for systemic toxicity. Chan et al[16] compared ropivacaine 1.2mg/kg

and 1.8 mg/kg (maximum dose 180 mg) with lidocaine 3 mg/kg for IVRA. They found that compared with lignocaine, IVRA with ropivacaine had similar times to onset of complete sensory and motor block but produced longer lasting residual analgesia. Although they did not observe any complications with the use of ropivacaine, the safety of ropivacaine for IVRA remains to be determined.

Unfortunately, IVRA may be associated with tourniquet pain and does not provide adequate postoperative analgesia. In an attempt to improve the quality of the block, various adjuvants including opioids (eg. fentanyl, meperedine, tramadol & morphine), nonsteroidal anti-inflammatory drugs (eg. Ketorolac), α2 adrenergic agonists (eg.clonidine), sodium bi carbonate and muscle relaxants (eg. atracurium and pancuronium) have been added to the local anaesthetic solution with varying degree of success. Although combination of meperedine with lidocaine for IVRA provides a dose dependent improvement in post-operative analgesia, the incidence of opioid related side effects is increased[17]. The addition of Tramadol Hcl (50 mg) to 0.5 % lignocaine for IVRA results in prolonged post-operative analgesia and a reduced need for supplemental analgesics. It is also studied that Tramadol Hcl (100 mg) is also effective which can shorten the onset of sensory block, enhance the tourniquet tolerance & improve the post-operative analgesia. The combination of clonidine (150 µg) and lignocaine improves tourniquet tolerance during IVRA but does not improve post-operative analgesia. However, this combination may result in hypotension and sedation following tourniquet release, particularly if the duration of tourniquet inflation is short[18].

In this current study, no significant difference was observed between the two groups regarding demographic characteristics and types of surgery ($p>0.05$).

In our study, combination of Lignocaine and Tramadol Hydrochloride is significantly better & devoid of side effects and analgesics are required significantly less with respect to time to first analgesic and total analgesic in 24 hours. The result is supported by previous study[12].

The starting time of tourniquet pain 18 (60%) and 9 (30%) were found between 25-35 minutes in group L and group LT respectively out of which 8(44.4%) has mild pain & 10 (55.6%) had moderate pain in group L whereas in group LT 7 (77.8%) had mild pain and 2 (22.2%) had moderate pain. The mean pain score was significantly higher ($p<0.005$) in Group L than Group LT.

In this study, operative pain & adverse effect were not significant ($p>0.05$) between the two groups. Subsequently, the mean pulse rate & MAP difference of perioperative period were not statistically significant ($p>0.05$). But in a study IVRA using ketamine shows postoperative rise in pulse rate, respiratory rate & mean arterial pressure[19].

The mean duration of first analgesic demand was 75.8± 9.30 minutes in Group L and 109.61± 12.32 minutes in Group LT. The mean difference was significantly ($p<0.05$) higher in group LT with compared to group L. Moreover, the total analgesic demand in post-operative 24 hours is also significantly reduced in group LT ($p<0.000$).

Conclusion

Co-administered Tramadol Hydrochloride with 0.5% lignocaine for IVRA provided better control of intraoperative tourniquet pain, prolong postoperative analgesia, reduced analgesic supplement during the first postoperative day.

Declaration

Ethics approval:
Ethical approval was taken from the Ethical Review Board of Bangladesh Medical College.

Author contributions:
Conception and development of the idea
MAU, MKUK, MMK, MAR
Data collection *MKUK, MAR, MAU*
Data analysis *MAU, MAR*
Writing-Original draft preparation *MAU, MKUK, MMK, MAR*
Writing–Review & Editing *MAU, MMK*

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