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Comparison of Duration of Analgesia in the Axillary Block with Lidocaine and Granisetron/Lidocaine Combination in Patients Requiring Lower Elbow Surgery

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Abstract

Background: This study aimed to compare the use of lidocaine alone and granisetron/lidocaine combination in terms of the efficacy and continuity of the analgesic effect in the axillary block in patients requiring lower elbow surgery.

Materials and Methods: This study was a double-blind randomized clinical trial performed on candidates for elbow and lower elbow surgery who were considered for the axillary block. An ultrasonography-guided axillary block was performed by a linear transducer using a short-axis view with an in-plane technique. The patient was placed in the supine position with the arms outstretched and turned outwards. The ultrasound image should show the arteries and veins of the axillary branches at the end of the brachial plexus, conjoint tendon, biceps, triceps, and coracobrachialis muscle. The first group received lidocaine, and the second group received a granisetron/lidocaine combination. First, five mg/kg of lidocaine 0.5% was diluted to 40 ml with 0.9% saline. In the first group, 40 ml of lidocaine solution was injected after dipping the syringe in epinephrine. In the second group, two mg of granisetron was injected simultaneously with lidocaine solution administration.

Results: In total, 90 patients were included in the study. The results showed that the onset of sensory and motor block in the second group (granisetron/lidocaine combination) was significantly lower than in the first group (lidocaine alone) ($p<0.001$). Moreover, the continuity of sensory and motor blocks was significantly higher in the second group ($p<0.001$).

Conclusion: The concomitant use of granisetron with lidocaine improved all pain indicators in patients. This combination also led to more continuous sensory and motor blocks in a shorter time.

Key Words: Axillary Block, Lidocaine, Granisetron, Regional anesthesia.

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1- INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. If not managed, this unpleasant feeling makes the patient uncomfortable and leads to uncontrollable behavioral responses. In addition, chronic pain deteriorates the quality of life. Rapid and effective pain relief in patients is a humane act and a fundamental right of the patient and is highly recommended (1, 2). Some major complications of acute limb traumas include soft tissue damage, bone fractures, and joint dislocations that could cause pain and discomfort in the patient. Therefore, pain control is essential to improving care quality in patients (2, 3). The use of drugs to relieve chronic or acute pain is common to reduce and control pain, and their application is more common in patients with pain complaints and the required doses (3, 4). However, excessive use of these drugs leads to severe complications in the patient (5, 6). Another measure to relieve a patient's pain is hematoma and nerve block, which can be performed on different parts of the arm such as the armpits, elbows, hands, or fingers. In the elbow area, all three median, ulnar, and radial nerves can be blocked, and anesthesia can be induced in the distal forearm and hand area. A nerve block in the elbow is sufficient for relieving pain in most severe injuries (6-8). Blocking the mentioned three nerves leads to successful anesthesia since they innervate the forearm and hands. However, proximal damage to the forearm requires superficial nerve blocks in the lateral, medial, and posterior regions. The radial nerve and the sensory branch of the musculocutaneous nerve lie together between the biceps and the brachioradialis on the anterior-lateral side of the elbow (9-12). Lidocaine is the primary drug in intravenous regional anesthesia (IVRA) in most clinical cases. Studies have investigated adding a second drug to improve the effect of lidocaine on pain relief and onset time of analgesia in patients and increase of duration of anesthesia. Specific 5-HT3 serotonin receptor antagonists such as ondansetron, granisetron, and dolasetron have a positive and uncomplicated effect on the treatment of nausea and vomiting. In some studies, the concomitant use of ondansetron and lidocaine in IVRA has led to more efficient results compared to the administration of lidocaine alone (13, 14). With this background in mind, the present study aimed to evaluate the effectiveness as a primary consequence and continued analgesic effect as a secondary consequence in axillary blockage by lidocaine in patients requiring below-elbow surgery and compare it with the granisetron/lidocaine combination.

2- MATERIALS AND METHODS

2-1. Method

This study was a double-blind randomized clinical trial performed on patients with bone damage who were candidates for elbow and lower elbow surgery and considered for the axillary block. Inclusion criteria were the age range of 15 to 60 years, being a candidate for elbow and lower elbow surgery, consciousness level above 14 according to Glasgow criteria, lack of allergy to lidocaine and granisetron, not using drugs that interact with lidocaine and granisetron, lack of lesion or infection at the injection site, and lack of history of coagulation diseases. Exclusion criteria were unwillingness to participate in the research and sensitivity during drug injection so as to lead to its discontinuation. Subjects were selected by nonprobability convenience sampling, and all who met the inclusion criteria were enrolled in the research. Sampling continued until reaching the required number of samples, and the patients were allocated to two groups using a balanced

block randomization method. In addition, blinding was performed by not informing the patient and the therapist about the type of injected drug (double-blind). Written informed consent was obtained from all participants after receiving approvals from the ethics committee and registering the research on the Iranian Registry of Clinical Trials (IRCT).

2-2. Regional anesthesia method

The ultrasonography-guided axillary block was performed by a linear transducer using a short-axis view with an in-plane technique. The patient was placed in the supine position with the arms outstretched and turned outwards. The ultrasound image should show the arteries and veins of the axillary branches of the end of the brachial plexus, conjoint tendon, biceps, triceps, and coracobrachialis muscle. Usually, the connection of the terminal branches with the axillary artery is as follows: median (superficial), ulnar (on the side of the medial artery), radial (on the side of the posterior artery), and musculocutaneous nerve (on the side of the lateral artery passing through the coracobrachialis muscle). A five- to seven-cm block needle was directed toward the branches of the brachial plexus from the proximal to the distal using the in-plane technique. The first group received lidocaine alone, and the second group received the granisetron/lidocaine combination. First, five mg/kg of lidocaine 0.5% was diluted to 40 cc with 0.9% saline. In the first group, 40 cc lidocaine solution was injected after dipping the syringe in epinephrine. In the second group, two mg of granisetron was injected simultaneously with lidocaine solution. All injections were performed by a person who was blinded to the type of drug injected.

2-3. Onset and continuity of effect

The onset of sensory block was calculated from the time of anesthetic injection to the negative pinprick test in the elbow area and below it. The onset of motor block was estimated from the time of anesthetic injection until the patient was unable to have full flexion, extension, and finger reduction. The duration of the sensory block was considered from the time of anesthetic injection until the return of the pinprick test in the elbow and lower area, and the duration of the motor block from the time of anesthesia injection until the return of flexion, extension, and reduction of fingers. The duration of painlessness was from the onset of the sensory block until the need for analgesia to relieve pain.

2-4. Pain measurement criteria

The pain was measured in patients before and after the injection using the numeric rating scale (NRS) (0-10), where zero was indicative of no pain and 10 indicated severe pain, and patients determined the severity of their pain on the NRS based on the presented images. Ultimately, the pain was recorded numerically in the questionnaire sheets.

2-5. Additional analgesic injection

This drug was injected into patients with a pain score of ≥6 (pethidine with a 0.5 mg/dl dose).

2-6. Desired consequences

The onset and duration of sensory and motor block, the pain score 6 and 12 hours after the procedure, and the first analgesic requirement time were recorded and compared. Blood pressure, heartbeat, and breathing of patients were assessed and compared before the study, every ten minutes during the procedure, and two and six hours after it.

2-7. Data analyses

Data analysis was performed in SPSS software version 21.0 using descriptive and analytical statistics after completing the checklists and collecting the data. For descriptive statistics, quantitative data were as mean ± standard deviation, and the

qualitative data were reported by percentage. The research hypotheses were assessed using analytical statistics. After examining the normality of the data using the Kolmogorov-Smirnov test, independent t-tests in quantitative variables or a chi-square in qualitative variables were used to investigate the differences between the variables in the two groups. A p-value of below 0.05 was considered statistically significant.

3- RESULTS

In total, 90 patients entered the study in two equal groups of 45. Pain relief occurred with lidocaine alone in the first group and granisetron/lidocaine combination in the second group. The mean age of the participants was 34.48±9.00, and the lowest and highest ages of patients were 18 and 58 years, respectively. Overall, 61 patients (67.8%) were male, and 29 (32.2%) were female. Surgery was performed on patients to treat elbow dislocation fracture and elbow dislocation with associated distal radius fracture. The mean duration of surgery was 1.5±0.35 hours, and there was no statistically significant difference between the groups in this regard (p=0.135). The groups were assessed in terms of vital signs (e.g., systolic and diastolic blood pressure, heartbeat, and respiratory rate) before the procedure, and no significant difference was observed between the groups in this respect (**Table.1**). The vital signs of the patients in the two groups were examined in subsequent evaluations, and there was no statistically significant difference in the mean between the two groups. Furthermore, no complication was observed in the participants, and pain intensity decreased in both groups six and 12 hours after axillary block, and there was no significant difference between the groups. The onset of sensory and motor block was significantly shorter in the second group (granisetron/lidocaine combination) than in the first group (lidocaine alone). In other words, sensory and motor block occurred faster in the group receiving granisetron. Also, the continuity of sensory and motor blocks was significantly higher in the second group. In other words, sensory and motor block continued for a longer time in the group receiving granisetron. During the surgery, five participants in each group required additional analgesic administration (11%). In this regard, pethidine was administered in the two groups to create more analgesia during surgery, and there was no significant difference between the groups regarding the therapeutic dose and number of injections (p=0.121). The first analgesic requirement time (minute) was significantly lower in the first group compared to the second group. In other words, those receiving lidocaine alone required an additional analgesic sooner than those receiving the granisetron/lidocaine combination (**Table.2**).

Table-1: Demographic and clinical characteristics of the participants at the beginning of the study.

Variables		Lidocaine group Mean ± SD	Granisetron/lidocaine combination group Mean ± SD	Statistical test
Age (year)		34.27±11.56	33.68±11.04	P=0.800
Heart beat (per minute)		76.64±7.38	80.29±6.47	P=0.110
Respiratory rate (per minute)		17.24±1.76	17.60±1.04	P=0.217
Systolic blood pressure (cmH2O)		12.43±1.19	12.13±0.54	P=0.120
Diastolic blood pressure (cmH2O)		7.66±0.87	7.82±0.50	P=0.268
Gender	Male	32 (71.1%)	29 (64.4%)	P=0.499
	Female	13 (28.9%)	16 (35.6%)	

P<0.05 was significant, SD: Standard deviation.

Table-2: Comparison of mean of onset and continuity of sensory and motor block and the time of the first analgesic requirement in each group.

Variables	Lidocaine group Mean ± SD	Granisetron/lidocaine combination group Mean ± SD	Statistical result
Onset time of sensory block (minute)	18.00±2.03	14.73±1.33	P=0.001
Onset time of motor block (minute)	25.67±3.43	21.95±4.19	P=0.001
Continuity of sensory block (minute)	136.44±8.35	185.70±5.95	P=0.001
Continuity of motor block (minute)	149.64±8.00	213.79±6.56	P=0.001
The first analgesic requirement time (minute)	162.98±33.58	200.34±10.54	P=0.001

P<0.05 was significant, SD: Standard deviation.

4- DISCUSSION

The present study investigated reducing the pain experienced by patients and maintaining painlessness in patients requiring lower elbow surgery. Granisetron was used as an adjuvant, and its impact was assessed by estimating the effect of analgesics in the two groups. While the first group received lidocaine alone, the second group received a granisetron/lidocaine combination. The results were expressed and assessed in two general parts in the current research. Changes in vital signs during the study were measured at regular intervals of ten minutes to one hour, then every hour, and finally, six hours later. The plotted graph showed slight changes over time, but the changes were not significant. These changes were studied separately and statistically in the two studied groups in each time period. No statistically significant difference was found between the two groups. Similar results were obtained in related studies. In some studies, changes in vital signs were evaluated and compared every 15 minutes to the first hour and every 30 minutes to three hours, but there was no statistically significant difference in this regard (15, 16). In the current research, none of the patients had abnormal vital signs during the study. However, in s similar research (17), one patient was excluded from the study due to palpitations and increased heart rate and respiration, which was reported to be the result of a drug reaction. In the second part, pain and anesthesia were analyzed in patients. At the beginning of the study, none of the patients reported any pain. Therefore, it was expected to detect no pain after the injection of solutions. After the block, the pain increased in both groups in a way that the patients in the two groups required analgesics. However, despite receiving the first dose of analgesia about three hours after the block, the pain of patients in both groups was still higher than five points in the evaluation at the sixth hour. Nonetheless, the pain gradually decreased to three points in patients at the 12th hour of the block and by receiving the next doses of analgesic. Sensory and motor block indices were also used to evaluate the effectiveness of the drug. The first index determined the sensory block time, which was under 15 minutes in the granisetron/lidocaine combination group and under 20 minutes in the lidocaine group. In addition, the motor block was initiated earlier in the granisetron/lidocaine combination group compared to the

lidocaine group (the 21st minute vs. the 25th minute). The significance of the sensory and motor block time showed the early impact of the granisetron/lidocaine combination compared to the use of lidocaine alone. In the research by Honarmand et al. (13), the addition of eight mg of ondansetron resulted in faster sensory and motor block compared to patients receiving lidocaine alone. In addition, patients receiving lidocaine and ondansetron experienced quicker anesthesia in the study by Farouk et al. (14). In the present research, the continuity of the motor and sensory blocks was also assessed. The time of sensory and motor block is important in the patient's analgesia and leads to relaxation of the patient and the physician during the procedure. The difference between the mean duration of sensory and motor block in the granisetron/lidocaine combination group and the lidocaine-alone group was approximately 50 and 65 minutes, respectively, which is significant. The difference in anesthesia time can be highly valuable in performing the procedure. Consistent results were obtained in similar studies. For example, the group receiving lidocaine with eight mg of ondansetron experienced longer continuity of the sensory and motor blocks compared to the lidocaine-alone group in the study of Honarmand et al. (13). Similarly, the group receiving ondansetron had an earlier onset and a longer effect in the study of Farouk et al. (14). Block continuity was significantly higher in the ondansetron group compared to the magnesium group in the study of Kayalha et al. (17). The increase of the first analgesic requirement time was significantly higher in the granisetron/lidocaine combination group compared to the lidocaine alone group (200 minutes vs. 162 minutes), which is in line with other relevant studies. In the study by Farouk et al. (14), the first analgesic requirement time was longer (172 minutes vs. 85 minutes), and fewer patients required analgesics after surgery in the ondansetron group. In a study by El Bahnasawy et al. (15), the number of patients requiring analgesics was lower, and the intervals were longer in the ondansetron-receiving group compared to the others. Kayalha et al. (17) reported a higher need for analgesics at shorter intervals in the group receiving lidocaine alone. The results of the present study indicate that the granisetron/lidocaine combination can be used in sensory and motor block by physicians in various fields (emergency, orthopedics, surgery, and anesthesia) when performing upper extremity procedures. It is also suggested that clinical assessments and studies be conducted for the block of non-upper extremity blocks under specialized supervision so that the effect of the granisetron/lidocaine combination is determined in other limbs.

5- CONCLUSION

The results of the present study showed that the concomitant use of granisetron with lidocaine improved all pain indicators in patients. In addition, the granisetron/lidocaine combination led to the sensory and motor blocks at a shorter period and higher continuity.

6- CONFLICT OF INTEREST: None.

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