



Comparison of Hematoma Block and Wrist Block in the Treatment of Fracture of Neck of Fifth Metacarpus

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Abstract

Background: Fracture of neck of fifth metacarpal bone or boxer fracture is one of the most common types of hand fracture. Nowadays, two analgesic methods, hematoma block and wrist block, are used at the emergency unit for relocating the fracture. The aim of this study was to compare the advantages and disadvantages of these two methods.

Methods: In this randomized clinical trial, all male patients between age of 18 and 60 years were evaluated regarding the inclusion criteria and divided to two groups. In the first group (wrist block), after finding the landmarks and using nerve locator, the radial, median, and ulnar nerves were blocked using 2% lidocaine. In the second group (hematoma block), 2% lidocaine was injected at the site of fracture hematoma. Patients' pain in both groups was assessed using the visual analogue scale (VAS) before, during, and five minutes after reduction. Correction of angle of fracture and hand grip power were evaluated at two months, post-treatment.

Results: Forty-eight patients in the wrist block and 50 patients in the hematoma block were enrolled. In both groups, pain level based on VAS score was decreased during and at five minutes after reduction, which was significant in the wrist block group at both times. No significant associations were detected between correction of angle of fracture and recovery of hand grip power at two months post-treatment with type of analgesia. Also, grip power showed a significant negative association with age, only in the wrist block group.

Conclusions: This study demonstrated that wrist block is more effective than hematoma block during and at five minutes after reduction. However, two months after treatment, it was found that grip power is inversely proportional to the age of the wrist block group.

Keywords: Fifth Metacarpal Bone, Hematoma Block, Wrist Block

1. Background

Fracture of neck of fifth metacarpal bone, which is also called boxer fracture, is one of the most common types of fractures. It contains approximately 5% of all fractures of the upper limb, and 18% to 44% of hand fractures (1, 2). Boxer fracture is usually caused due to a pressurizing force in the longitudinal direction on the metacarpophalangeal joint when hitting the fist on a hard object (3). This fracture may be accompanied by the angled of broken parts. If it is angled more than 40 degrees, it will cause weakness and impairment in performance and hand power. On the other hand, there are four round knobs at the site of the connection of metacarpus and fingers during fisting, which is called knuckle. These knobs may disappear in the fracture of metacarpus, which is associated with displacement. Although this will not cause a functional problem but create

an inappropriate shape (1). Inappropriate treatments of metacarpal fractures may deform fingers and also result in functional impairment of the metacarpophalangeal joint (2).

Considering that in most cases, this fracture is relocated in emergency as closed condition, choosing an effective and reliable analgesic method is a major challenge (4). One of these analgesic methods, which is presented in various studies, is the block of the wrist nerve (WB). In this method, the end part of the ulnar, medial, and radial nerves are blocked at the wrist site, as a safe method without systemic complications (5).

Although the WB is rarely used in rheumatology, sports medicine or family practice, this is common in hand surgery, orthopedic surgery, and emergency situations (6). Hematoma block (HB) is another method, in which a local anesthetic agent is injected in the joint and the frac-

ture related hematoma. Mechanism of HB is the block of the nerve fibers, especially small non-myelinated nerves around the affected area, which inhibits the production and transmission of pain stimuli (7, 8).

There are controversies in different studies considering which of these two methods is more effective and provides faster and stronger analgesia (6, 9). Therefore, the current researchers aimed at comparing these two block methods and evaluated their advantages and disadvantages.

2. Methods

In this clinical trial, 18- to 60-year-old male patients with fracture of neck of fifth metacarpal bone and fracture angle of more than 40° , who were under treatment in the academic orthopedic center, were enrolled. Patients with local drug sensitivity, active infection at the injection site, coagulopathy disorders, drug abuse, and incomplete information were excluded.

The WB method in the first group and HB method in the second group were used for local anesthesia to relocate fracture of neck of fifth metacarpal bone. In the WB method, after finding landmarks and using nerve locator, 5 to 7 mL of 2% epinephrine-free lidocaine (Caspian Taemin Co, Iran) for block of radial and median nerves and 4 to 5 mL of the 2% epinephrine-free lidocaine for block of ulnar nerve was used. In the HB method, 3 to 5 mL of 2% epinephrine-free lidocaine was injected in the fracture-related hematoma, as barbotage (repeated injection and aspiration of fluid). The second author performed all anesthetic procedures, and the related time in both groups was recorded.

The first author relocated the fracture by flexion of Metacarpophalangeal (MP) joint as 90 - 90 method in the way that the pressure down on the dorsal area of the fracture caused upward movement of MP joint. After reduction, ulnar gutter splint was used and patient's pain was evaluated using the visual analogue scale (VAS) method before, during, and five minutes after reduction. Patients were followed up after two months and correction degree of the fracture angle (according to the sideview of the hand graph) was measured using a goniometer. In addition, the grip power of the fifth finger (compared to the opposite side) was measured using a dynamometer (Figure 1).

2.1. Statistical Analysis

Data were analyzed using the SPSS version 21 software. The Shapiro test was used to evaluate data normality. Due to abnormal distribution of data, Wilcoxon signed ranks test for evaluation of before and after distributions and

Mann-Whitney test for comparison of changes in the two groups were used. P values of lower than 0.05 were considered statistically significant.

Sample size in both groups was calculated based on Equation 1.

According to a pilot study on the two groups, each with 10 patients, standard deviation in the WB (δ_1) and HB (δ_2) of 7.95 and 8.18, respectively, $\alpha = 0.05$ and $\beta = 0.1$ and considering the clinical difference ($\mu_1 - \mu_2$) as 5° , total $n = 49$ was calculated. To overcome possible 10% loss of follow up, five or six patients were also added to each group, and finally 54 patients in WB and 55 patients in HB were allocated by the block randomization method.

3. Results

In this study, after two months, six patients from the WB group and five patients from the HB group were excluded due to loss of follow up, and in total 48 patients in the WB group and 50 patients in the HB group were evaluated (Figure 1). Mean age of patients in the WB and HB was 36.67 and 34.6 years, respectively, which showed no significant statistical difference between two groups, based on the *t*-test. The mean time of anesthetic procedure was 10 to 15 minutes in the WB group and two to three minutes in the HB group.

Mean VAS score was measured before, during, and five minutes after reduction in both groups. Based on Table 1 and Wilcoxon signed ranks test, mean and standard deviation of VAS score during and five minutes after reduction was significantly decreased compared to before reduction in both groups ($P < 0.01$ and $P < 0.001$, respectively).

Mann-Whitney test of assessing of reduction in pain sensation during and before reduction (Table 1) demonstrated that decrease in WB group was higher than HB group (mean difference: 3.07 ± 1.11 versus 2.26 ± 1.25 , $P = 0.02$). Moreover, reduction of pain sensation at five minutes after reduction in comparison to before that in the WB group was higher than the HB group (mean difference: 4.12 ± 3.14 versus 3.14 ± 1.1 , $P < 0.001$). These data showed a better pain reduction during and 5 minutes after reduction in the WB group compared to the HB group.

After two months, the degree of fracture angle and grip power were evaluated in the study groups. According to Table 2, the degree of fracture angle and grip power were not significantly different in HB and WB groups based on the Mann-Whitney test.

No significant association was detected between changes of angle correction and age. Although the relationship between grip power and age was not statistically significant in the HB group ($r = 0.102$, $P = 0.487$), recovery of

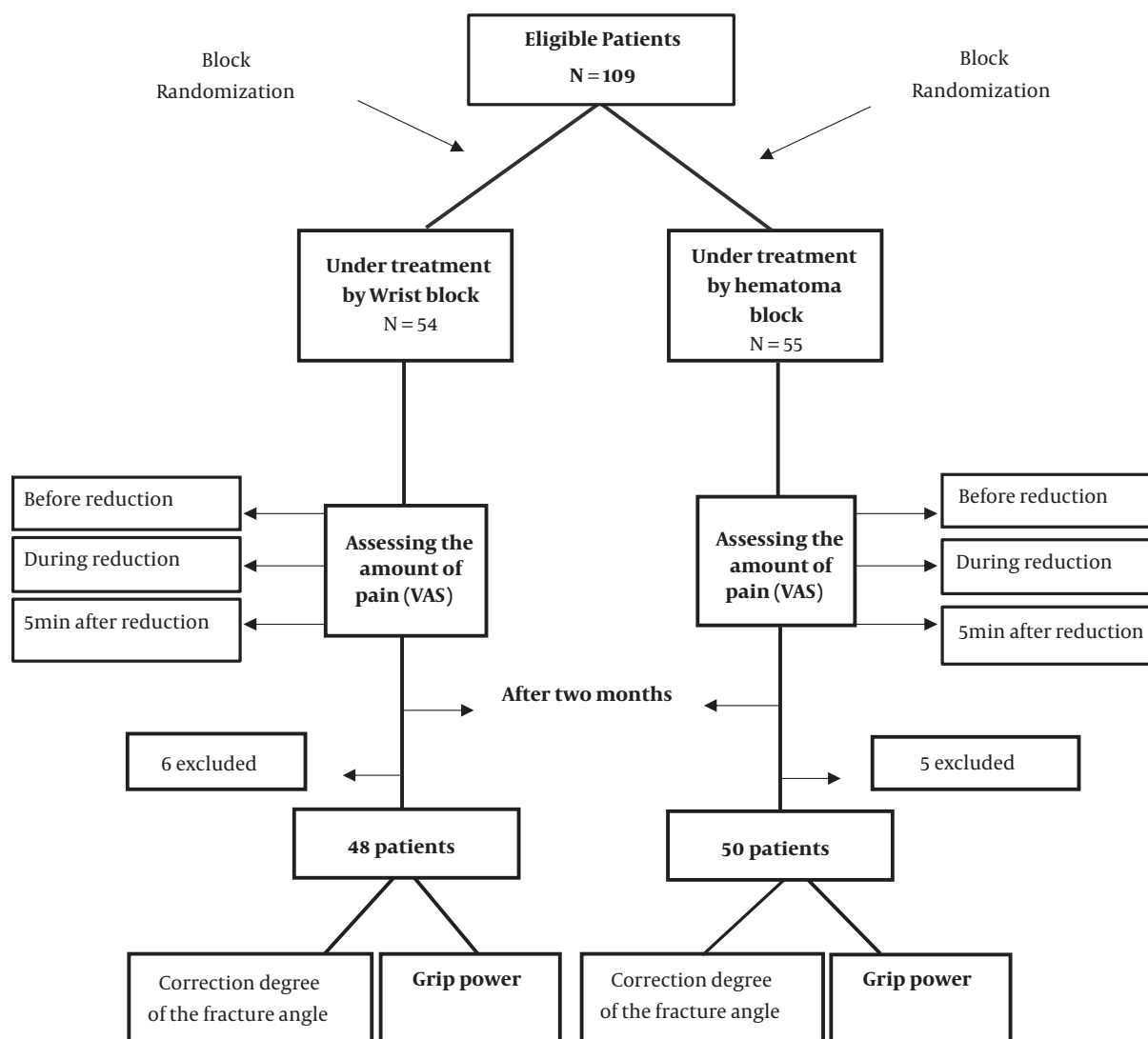


Figure 1. Study protocol

Table 1. Comparison of Mean, Standard Deviation and Mean Difference of Pain Sensation Based on VAS Score in Wrist Block and Hematoma Block Groups^a

Group	VAS Before (A)	VAS During (B)	VAS After (C)	Diff (A,B) ^b	Diff (A,C) ^c	P Value (A,B)	P Value (A,C)
WB	6.1 ± 0.53	3.03 ± 0.88	1.98 ± 0.79	3.07 ± 1.11	2.40 ± 4.12	< 0.01	< 0.001
HB	6.03 ± 0.91	3.77 ± 0.8	2.89 ± 0.56	1.25 ± 2.26	1.10 ± 3.14	< 0.01	< 0.001
P value				0.02	< 0.01		

^aValues are expressed as mean ± SD.

^bChanges in pain sensation before and during reduction based on VAS score.

^cChanges in pain sensation before and after reduction based on VAS score.

muscle strength showed a significant negative association with age in the WB group ($r = -0.688$, $P = 0.001$) (Table 3).

4. Discussion

In this study, although the pain score in both groups was reduced according to the VAS score, the WB method

Table 2. Level of Angle Correction (Degree) and Recovery of Grip Power (Percentage) in Wrist Block and Hematoma Block Groups

	Hematoma Block			Wrist Block			P Value
	Number	Mean \pm SD	Median	Number	Mean \pm SD	Median	
Correction of fracture angle	50	32.08 \pm 10.14	38	48	30.41 \pm 8.28	30	> 0.05
Grip power	50	94.73 \pm 3.23	100	48	97.12 \pm 3.39	100	> 0.05

Table 3. Association of Level of Angle Correction and Recovery of Grip Power with Age in Wrist Block and Hematoma Block Groups

	Hematoma Block			Wrist Block		
	Number	Spearman's rh Correlation Coefficient	P Value	Number	Spearman's rh Correlation Coefficient	P Value
Correction of fracture angle	50	-0.34	> 0.05	48	0.259	> 0.05
Grip power	50	0.102	> 0.05	48	-0.688	< 0.001

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

Equation 1

was more effective than HB in pain relief during and five minutes after the procedure.

Macaire et al. showed that when peripheral nerves are blocked in the hand fracture, the anesthetic effect increases and fractures are treated more easily (10). Also, Hadzic et al. expressed that WB compared to general anesthesia caused localized anesthesia with better performance in a shorter time, and provided faster improvement, fewer side effects, and less pain in surgeries and fractures of the wrist (11). In another similar study, Wilmer et al. also used the WB for lidocaine injection in the palmar surface of hands to treat trigger finger and synovial inflammation. Their study showed that block of ulnar and median nerves of hands before injection significantly reduced pain (6). In the WB method, three nerves, including median (palmar surface, thumb, index, middle, and radial-half of the ring fingers), ulnar (inner part of the ring and little fingers), and radial (top of the hand, thumb, index, and sometimes the middle fingers) are blocked (12). It seems that, although the time needed for nerve blocking in this method is more than the HB method, yet because of the direct block of the peripheral nerves of the wrist, the loss of the palm sense, especially in the metacarpal area of fifth and the inner part of the metacarpus of fourth fingers is more perceptible. Consequently, the patient feels less pain due to creation of a total numbness of the hand during reduction. While in the HB method only fracture re-

lated hematoma area (fifth metacarpus) is blocked. Therefore, the patient may still feel little pain during the reduction and treatment steps. When HB was compared with Bier's block in Colles' fracture by Kendall et al., they showed that, despite the effectiveness of HB, Bier's block was safer and better in effectiveness, control of pain at different stages, and also in the practical approach (13). All of these studies, including the current study, showed that regional anesthesia methods are more effective than the HB method in producing analgesia. However, Verma et al. showed opposite of this and reported that there was no difference between the HB and intravenous regional anesthesia in the anesthesia of the forearm fracture (14). On the other hand, one of the surgeons' concerns about metacarpal fractures was angled fingers. Biomechanical studies showed that angling of more than 40 degrees reduced movement in the MCP joint and weakened the grip power of the hand in addition to the deformation and aesthetics of the fingers (15). In the present study, the correction level of fracture angle and grip power were also studied after two months. In both groups, the fracture angle was corrected after two months and the grip power was also improved. Therefore, the changes in the improvement process of grip power and correction of fracture angle in both groups were acceptable. Therefore, it seems that the type of anesthetic method in the treatment of neck fractures of the fifth metacarpal bone does not have any effect on the improvement of grip power and the correction level of the fracture angle.

Regarding the association between the recovery of grip power and age in the two treatment groups, it was found that in the WB group, grip power had a negative association with age. Koley and Singh (16) and Ranganathan et al. (17) showed that with increasing age and muscle atrophy, individual grip power decreases. Generally, two mechanisms are responsible for the loss of muscle strength of

hands; first, the reduction of functional motor units and atrophy of fast muscle fiber and second, the reduction of muscle strength in people with old age (18). Regarding the direct block of peripheral nerves in the WB method compared to HB method and possibly because of muscular atrophy in older patients, grip power seems to be more decreased in relation to their age in patients with WB. Thus, according to the current results, the WB seems to be inappropriate in older patients.

In total, the results of this study showed that although the duration of the procedure was longer in the WB method (10 to 15 minutes) than the HB method (two to three minutes), this does not seem to be important and moreover, pain relief after reduction is more pronounced in patients with WB. Conclusively, it may be helpful to carry out more studies with larger sample sizes to suggest the WB method as the main anesthetic method in the fracture of the fifth metacarpal neck.

4.1. Conclusion

This study showed that although WB anesthesia is more effective in reducing pain during and five minutes after reduction compared to HB, yet had a negative effect on reducing the grip power after two months in patients with old age.

Footnote

Conflicting of Interests: All named authors hereby declare that they had no conflicts of interest to disclose.

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