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EVIDENCE BASED CARE

Comparison of the Effect of Two Methods of Hugo Point Massage on Pain Intensity, Anxiety, and Success rate of Arterial Blood Sampling

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Abstract

Background: Pain is the most common complication of arterial blood sampling that leads to patient's fear and anxiety, lack of cooperation, and dissatisfaction and reduces the success of sampling.

Aim: This study aimed to compare the effect of two methods of Hugo point massage with ice and without ice on pain intensity, anxiety, and the success of arterial blood sampling.

Method: This experimental study was performed on 90 patients in Imam Reza Hospital in Mashhad, Iran, in 2020. Sampling was conducted using the convenience sampling method and 30 participants were randomly assigned to three groups. In the group of Hugo point massage with ice, the Hugo point was massaged with ice marbles for 5 min before sampling. However, in the group of Hugo point massage without ice, the massage was performed only by the thumb. Eventually, the routine method of sampling was applied in the control group.

The intensity of pain and anxiety in patients was measured using the Visual Analogue Scale and six-item Spielberger Anxiety Scale, respectively. Moreover, the arterial blood sampling duration, the number of arterial blood sampling, and arterial blood sampling result were documented as well. Data were analyzed using SPSS software (Version 25) through Kruskal-Wallis, Chi-square, analysis of variance, and Wilcoxon tests.

Results: The mean±SD pain intensity of patients in the group of Hugo point massage with ice (1.50±0.57) was significantly lower than that in the groups of Hugo point massage without ice (2.25±1.21) (P=0.019) and control (2.80±0.92) (P<0.001).

The mean±SD score of anxiety after intervention in the group of Hugo point massage with ice (11.67±0.96) was significantly lower than that in the groups of Hugo point massage without ice (12.63±2.11) (P=0.040) and control (13.50±2.03) (P<0.001). No significant difference was observed among the three groups in terms of the mean±SD of blood sampling duration and the number of arterial blood sampling.

Implications for Practice: Hugo point massage with ice is suggested to be used as an available, efficient, and cost-effective method before arterial blood sampling.

Keywords: Anxiety, Blood gas analysis, Hugo point, Massage, Pain measurement

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Introduction

Arterial Blood Gas (ABG) analysis is an important diagnostic tool in the management of hospitalized patients with critical illnesses (1). Arterial blood sampling, as one of the most painful laboratory procedures, is related to such complications as arterial injury, bleeding, thrombosis, aneurysm formation, and distal ischemia (2-3). The pain caused by arterial blood sampling can lead to the patient's anxiety. Moreover, failed attempts to obtain blood sampling may dissuade the patient from receiving nursing care (4-5). On the other hand, anxiety associated with invasive procedures leads to the prolongation of the procedures, difficulty in performing the procedure, or even physical harm to the patient (6).

Today, the improvement of the quality of health care delivery has received increasing attention from health organizations since it affects people's health (7). Moreover, pain and anxiety relief are considered the basic principles of health care and an indicator of health care quality and patient satisfaction. However, no specific intervention has been recommended to relieve pain and anxiety caused by arterial blood sampling in clinical nursing standards, and arterial sampling is carried out without using pain and anxiety control strategies (3, 8).

A review of literature shows that researchers have tried different drug methods to relieve the pain of arterial sampling. In this regard, local anesthesia with intradermal injection of lidocaine (3, 9) and the use of local anesthetic ointments have been recommended in some studies. However, nurses and physicians are unwilling to utilize drug interventions to relieve the pain of arterial blood sampling due to the long analgesic effect of the drug (from 30 min to 2 h) (10). Furthermore, there is the possibility of pain and allergic reaction during subcutaneous injection which may lead to the patient's lack of cooperation (3-5).

Some studies in the field of non-pharmacological interventions have recommended the application of ice packs topically at the sampling site to relieve the pain of arterial blood sampling (4, 11). Cold reduces nerve conduction velocity, increases pain threshold, and induces analgesia (12). However, the direct application of ice and cold to the arterial sampling site seems to reduce the palpability of the arterial pulse and the success of sampling. Therefore, the application of this method has limitations as well.

Massage therapy is another non-pharmacological method of pain relief (13). According to the gate control theory of pain, massage therapy can be effective in closing pain gates and prevent the transmission of noxious stimuli by large nerve fibers which in turn affects the perception of pain (14). Moreover, massage therapy increases the level of endorphins and serotonin which causes a feeling of relaxation (15). The use of finger or ice massaging for the stimulation of pressure and energy balance points in the body is also common in acupressure (16). The stimulation of these points activates the flow of vital energy in certain parts of the body and leads to the relief of pain in areas far from these points (17). Hugo point (LI4), as the most important analgesic point of the body, is located in the middle of the angle bisector between the first and second metacarp (18).

Studies have shown that Hugo point massage reduces vaccination pain in infants and toddlers, the pain caused by venous blood sampling, labor pain and anxiety, and the severity of primary dysmenorrhea pain and anxiety in students (18-21). Although studies have indicated the positive effects of Hugo point massage on pain relief in various clinical conditions, there is still limited information on the application of Hugo point massage with or without ice in reducing pain and anxiety and increasing the success of arterial blood sampling.

Given the frequency of arterial blood sampling in clinical wards and its importance for accurate diagnosis and management of patient care, it is necessary to adopt an easy, cheap, uncomplicated, and effective pain relief method. The importance of this matter lies in the fact that according to previous studies, pain and anxiety relief caused by invasive procedures increases the patient's satisfaction and cooperation (22), and reduces the complications of sampling, such as hematoma, vascular injury, and infection (23). Therefore, the present study was performed to compare the effect of two methods of Hugo point massage with and without ice on pain intensity, anxiety, and success of arterial blood sampling.

Methods

This was a three-group experimental study performed on patients admitted to Imam Reza Hospital, as one of the largest educational and medical centers in Mashhad, Iran, from April 2020 to June 2020. In

total, 90 eligible patients admitted to different wards of the hospital were selected using the convenience sampling method and randomly assigned to three groups of control, Hugo point massage with ice, and Hugo point massage without ice.

The sample size was determined using the results of the pilot study with an error rate 5% and a power of 80%. Afterward, the outcome of the sample size was estimated separately for the two quantitative variables of pain intensity and anxiety using the formula of comparing the means in the two groups. Based on the obtained result, the highest sample size was related to the pain intensity variable. Considering the effect size and 20% attrition rate, the sample size of the study was obtained at 30 participants in each group, and a total of 90 participants were included in the study. In Hugo point massage without ice, two patients were excluded from the study due to their unwillingness to continue participation in the study.

The inclusion criteria in this study included informed consent, the age range of 18-60 years, alertness, ability to read and write, healthy Allen test, lack of continuous infusion of sedatives, such as Midazolam, lack of painkiller use, lack of vascular disorders and bleeding disorders, such as hemophilia. However, those whose condition became critical, cases who started taking sedatives during the study, or were unwilling to cooperate in the study were excluded from the study.

The intervention in the group of Hugo point massage with ice included the massage of Hugo point (between the thumb and the index finger of the hand on which sampling was performed) with an ice cube (2 cm diameter) placed inside plastic gloves and one layer cotton cloth in a clockwise direction for 5 min before radial artery sampling. The massage pressure was moderate and equivalent to a pressure of 3 kg, which was measured and adjusted with a calibrated digital scale before sampling. The Hugo point massage with ice was stopped for 10 seconds after every one minute of massage. Arterial blood sampling was carried out after 5 min of massaging the Hugo spot with ice in the explained manner. In the group of Hugo point massage without ice, the massage procedure was carried out according to the above protocol without using ice. In the group of control, arterial blood sampling was performed routinely (without pain control interventions). It is worth mentioning that in all three groups the nurse in charge of arterial blood sampling, needle size (Insulin syringe, Iran Medical Supplies Company, Size 27) were the same.

Moreover, the arterial blood sampling was conducted by a trained and experienced member of the research team in the relevant ward and at the patient's bedside. The person performing the intervention learned the Hugo point massage under the supervision of a complementary medicine specialist, who was a faculty member of the university and performed the intervention after obtaining a valid certificate. Those who collected and analyzed data were blinded to the study groupings. In all three groups, such data as the severity of pain caused by arterial blood sampling, patient anxiety before and immediately after each successful sampling, the number of attempts to obtain a successful sample, the sampling result, as well as the sampling time (from needle entry time to the time of needle exit) were recorded by the research assistant.

Data collection tools included a participant's checklist, patient demographic characteristics form (including such information as age, body mass index, length of hospitalization, gender, marital status, education level), Visual Analogue Scale, six-item Spielberger Anxiety Scale, and the form for the successful recording of arterial blood sampling which was completed entirely by the research assistant. The Visual Analogue Scale, the validity and reliability of which has been confirmed in previous studies (26-24), included a horizontal 10 cm long line that was numbered from 0 to 10, in which the numbers 0 and 10 indicated "no pain" and "the most severe pain" that the patient might experience, respectively.

In this study, the patient was asked to determine the severity of pain caused by radial artery sampling immediately after arterial blood sampling on a horizontal line from 0 to 10. In addition, the assessment of the patient's anxiety was conducted using the 6-item Spielberger Anxiety Scale, which its validity and reliability have been confirmed in the study conducted by Mehran (1994) (27). This questionnaire consisted of six parts, including a feeling of calm, stress, confusion, comfort, satisfaction, and worry, and the patients' responses to these questions were assessed using a Likert scale with such options as "never, somewhat, to some extent, and very much" before and after the sampling procedure. The lowest and the highest scores in this questionnaire were 6 and 24, respectively. A sampling registration form designed by the researcher was used to record the time of arterial blood sampling, the number of sampling attempts, and the result of sampling. The validity and reliability of the mentioned form were reviewed and confirmed by ten experts.

The researcher referred to different wards of Imam Reza Hospital, Mashhad, Iran, to collect data after the approval was obtained from the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran. The researcher then introduced himself to the patients and explained the study objectives and method. The informed consent was obtained from the participants and they were ensured about the anonymity and confidentiality of their information and the voluntary nature of their participation in the study. Subsequently, the patients were provided with the necessary explanations about responding to the visual scale and the Spielberger Anxiety Questionnaire. Afterward, the intervention was performed based on the approved method and the questionnaires were completed. The collected data were analyzed using SPSS software (version 25). One-way analysis of variance and Kruskal-Wallis test were used to compare the three groups in terms of quantitative normal variables and quantitative abnormal variables, respectively. In addition, the Wilcoxon test was also used for the intragroup tests of abnormal variables. Nominal variables in three groups were also compared and tested using the Chi-square test and Fisher's exact test. In the performed tests, the confidence interval and the significance level were 95% was 5%, respectively.

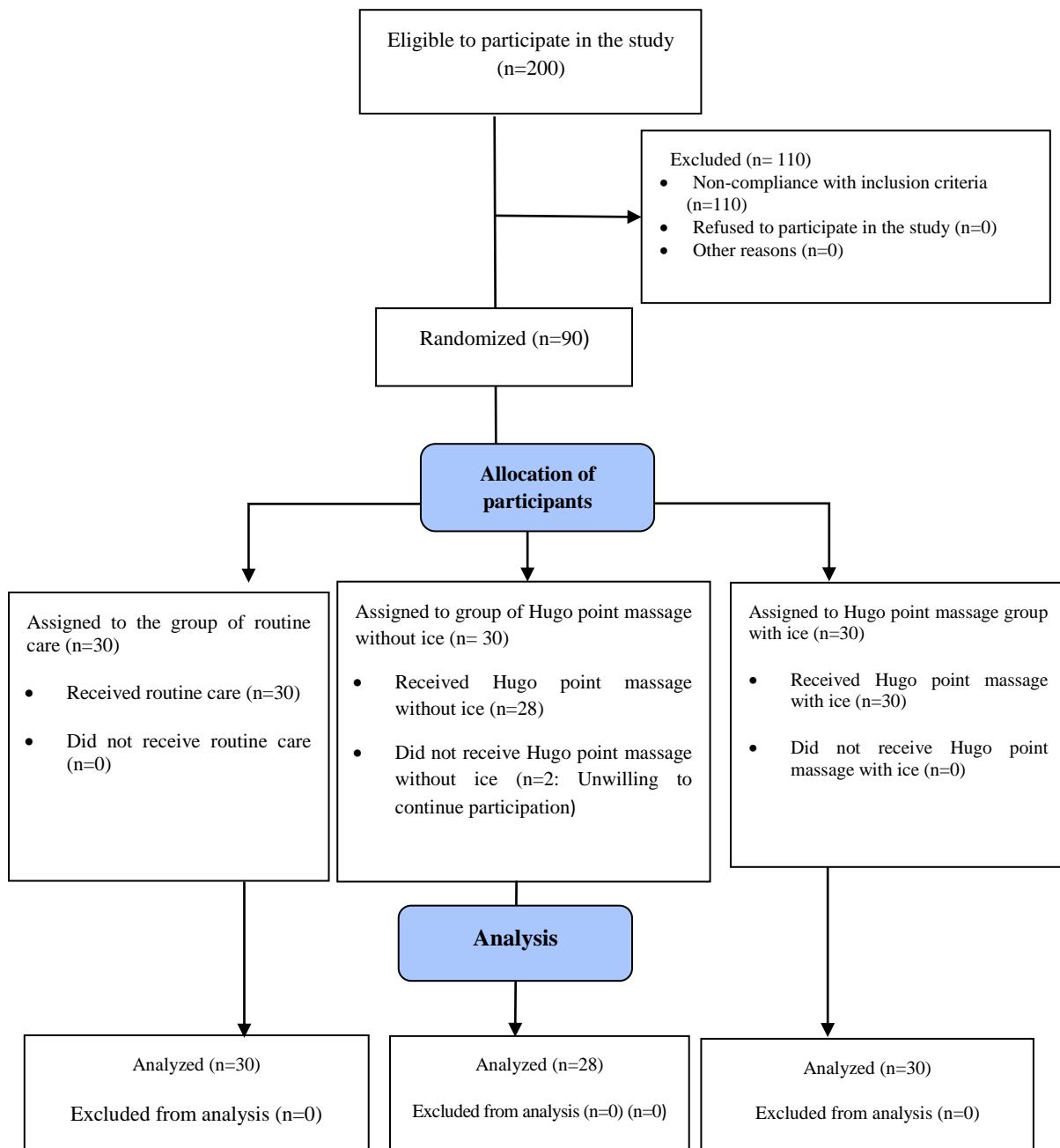


Figure 1. Consort Flow Diagram

Results

In the present study, the minimum and the maximum age of study participants were 28 and 60 years. Moreover, 48.8% and 51.2% of participants were male and female, respectively. Furthermore, 100% of patients in the groups of Hugo point massage with ice and without ice, and 96.7% of the patients in the control group had no previous experience of arterial blood sampling. Other demographic variables were homogeneous in the three groups of the study.

Based on the study findings, the mean pain intensity of the first round of blood sampling in the group of Hugo point massage with ice was significantly different from that in the group of Hugo point massage without ice and the control group ($P < 0.001$). Bonferroni post hoc test showed that the difference between groups of Hugo point massage with ice and Hugo point massage without ice ($P = 0.019$) and the difference between the group of Hugo point massage with ice and the control group was significant ($P < 0.001$). However, the difference between the groups of Hugo point massage without ice and the control group was not significant ($P = 0.076$) (Table 1).

In addition, the mean score of anxiety before arterial blood sampling of patients in the groups of Hugo point massage with ice, without ice, and control was not significantly different ($P = 0.178$). However, the mean post-intervention anxiety score in groups of Hugo point massage with ice, Hugo point massage without ice, and control group was significantly different ($P < 0.001$). The results of Bonferroni post hoc test showed that the difference between groups of Hugo point massage with ice and without ice ($P = 0.040$), and the difference between the group of Hugo point massage with ice and control group ($P < 0.001$) was significant. However, the difference between the group of Hugo point massage without ice and the control group ($P = 0.384$) was not significant. The in-group comparison revealed that the anxiety score after sampling was significantly reduced in the groups of Hugo point massage with ice ($P < 0.001$) and without ice ($P = 0.001$), compared to that before the sampling; however, this score significantly increased in the control group ($P = 0.017$) (Table 2).

Moreover, the first blood sampling was conducted successfully on 80%, 67.9%, and 70% of the participants in the groups of Hugo point massage with ice, without ice, and control, respectively. The Chi-square test showed that there was no significant difference in terms of the frequency of the result of the first arterial blood sampling in the three groups ($P = 0.536$) (Table 3). In addition, the mean duration of the first and second arterial blood sampling of the patients in the groups of Hugo point massage with ice, without ice, and control was not significantly different ($P < 0.05$) (Table 3).

Table 1. Mean \pm SD of pain intensity of studied patients in the three groups

Pain intensity	Group			Intergroup test result
	Massage with ice	Massage without ice	Controls	
Pain intensity in the first sampling	1.50 \pm 0.57	2.25 \pm 1.21	2.80 \pm 0.92	$P < 0.001^*$
Pain intensity in the second sampling	2.00 \pm 0.63	2.67 \pm 1.22	4.00 \pm 0.87	$P < 0.001^*$

* Kruskal Wallis

Table 2. Mean \pm SD of anxiety score of studied patients in the three groups

Anxiety		Group			Intergroup test result
		Massage with ice	Massage without ice	Controls	
Anxiety score	Before sampling	13.27 \pm 1.31	13.27 \pm 1.31	12.97 \pm 1.69	$P < 0.178^*$
	After sampling	11.67 \pm 0.96	12.63 \pm 2.11	13.50 \pm 2.03	$P < 0.001^*$
	Difference between before and after sampling	-1.60 \pm 1.16	-0.96 \pm 1.19	0.53 \pm 1.14	$P < 0.001^*$
Intergroup test result		$P < 0.001^{**}$	$P = 0.001^{**}$	$P = 0.017^{**}$	

* Kruskal Wallis

** Wilcoxon

Table 3. Frequency distribution of the studied patients in terms of arterial blood sampling result and mean±SD of arterial blood sampling duration in three groups

Sampling result / Sampling duration			Group			Intergroup test result
			Massage with ice	Massage without ice	Controls	
Result of arterial blood sampling	First sampling	Successful	22 (80)	19 (67.9)	21 (70)	P=0.536*
		Unsuccessful	6 (20)	9 (32.1)	9 (30)	
		Total	30 (100)	28 (100)	30 (100)	
	Second sampling	Successful	6 (100)	9 (100)	9 (100)	P=1.000**
		Unsuccessful	0 (0)	0 (0)	0 (0)	
		Total	6 (100)	9 (100)	9 (100)	
Duration of arterial blood sampling (S)	First sampling	40.43 ± 9.26	43.81 ± 11.25	42.87 ± 6.57	P=0.186***	
	Second sampling	38.00 ± 6.45	41.44 ± 5.81	40.33 ± 3.43	P=0.466****	

* Chi-square

** Fisher's exact test

*** Kruskal Wallis

**** Analysis of variance

Discussion

The results of the present study showed that after the intervention, the mean pain intensity caused by arterial blood sampling was lower in the group of Hugo point massage with ice compared to than in the groups of Hugo point massage without ice and control. Regarding the fact that there was no significant difference between the group of Hugo point massage without ice and the control group in terms of the mean pain intensity, it can be concluded that the application of cold at the Hugo point had a significant effect on the reduction of pain intensity caused by arterial blood sampling. These results have been confirmed in other studies, such as the study conducted by Hosseinzadeh et al. (2017) which compared the effect of cryotherapy and acupuncture at Hugo point on the pain of needle entry into vessels in hemodialysis patients (n=42) in selected hospitals in the city of Kerman, Iran. The results showed that the intensity of pain in the cryotherapy group at Hugo point was significantly lower than that in the Hugo point massage group (28). These findings can be justified by the analgesic mechanism of cold. Ice reduces the feeling of pain through inactivation of sensory nerves, reduction of nerve conduction velocity, and inhibition of pain through inhibitory interneurons (pain gate), as well as endorphin secretion (29-30).

The results of the present study indicated a decrease in the pain intensity in the group of Hugo point massage without ice compared to the control group. Although this reduction is not significant, it seems that the increase of sample size can make this finding significant. In the same line, a study was conducted by Khosravan et al. (2016) on the effect of Hugo point massage with ice and without ice on two-month-old infants (n=90) referring to the community health centers for vaccination. The results showed that the mean pain intensity in the group of Hugo point massage without ice was significantly lower than that in the control group (31). In this regard, the reduction of pain intensity after Hugo point massage can be attributed to the effect of massage on the closure of pain gates in the theory of gate control (14).

Moreover, the results of the present study showed that before the intervention, the mean anxiety scores of patients in the three groups were not significantly different. However, after the intervention, the mean anxiety score in the group of Hugo point massage with ice was significantly lower than that in the group of Hugo point massage without ice. However, the mean anxiety score in the group of Hugo point massage without ice was not significantly different from the mean anxiety score in the control group. Scientists believe that the sensory, emotional, motivational, and cognitive aspects of pain interact to produce a perceptual experience of pain, and this experience can be influenced by our memories, emotions, and level of attention (32). Anxiety is a factor that affects the experience of pain. The results of various studies indicate that anxiety can affect different aspects of pain perception, in a way that the rise of anxiety can increase pain intensity reported by the patient, decrease pain tolerance and pain threshold (33-34). Therefore, considering the interaction of emotional and perceptual components of pain, it seems that in the present study, the patient's anxiety decreased following the

reduction of pain intensity due to the massage of Hugo point with ice. The present study is consistent with the study performed by Kaviani et al. (2012) which compared the effect of the application of acupressure and ice massage at Hugo point (LI4) of women with first pregnancy (n=165) on the severity of anxiety during the labor.

The results of the above study revealed that acupressure and massage at Hugo point reduced the severity of pain and the level of anxiety of the client. After the intervention, the level of anxiety in the group of acupressure and the group of Hugo point massage with ice was significantly lower than that in the control group (35). The results of a double-blind randomized prospective study conducted by Lang et al. on 32 patients showed that the application of acupressure at Baihui and Hugo points is effective in the reduction of pain and anxiety in patients after distal radial fractures as part of the first-aid plan (36).

On the other hand, the results of the present study showed that unlike the group of Hugo point massage with ice and without ice, in which the patient's anxiety score reduced after arterial sampling compared to that before the sampling, in the control group, the score of post-arterial sampling anxiety increased significantly after the sampling. Therefore, it seems that the experience of unrelieved pain caused by arterial blood sampling in the control group has led to increased anxiety of these patients in the control group.

Based on the results of the present study, no significant difference was observed among the groups of Hugo massage with ice, without ice, and control in terms of the mean duration of arterial blood sampling and the results of arterial blood sampling. Therefore, it can be said that the success of arterial blood sampling was not affected by the severity of the patient's pain or anxiety. It seems that the employment of skilled nurses for arterial blood sampling is effective in this regard; however, further studies are needed. In this regard, the study of Aaron et al. (2003) showed that the use of tetracaine gel at the site of arterial sampling did not reduce the severity of blood sampling pain in patients (n=50) under the study and had no effect on sampling success and sampling duration as well. In this study, the researchers attributed the ineffectiveness of tetracaine gel to a 45 min delay from the use of the gel until the start of arterial blood sampling, which may increase patients' anxiety and reduce their pain (10).

In the study conducted by Hendry et al., intradermal injection of lidocaine before intravenous cannulation in healthy volunteers (n=45) reduced the severity of pain and the success of sampling in these individuals. The researchers in this study believed that the success rate of sampling in venous cannulation depends on the patient's vascular condition, which has not been studied in the present study (37).

In general, the results of the present study revealed that Hugo point massage with ice could reduce the severity of pain and anxiety in patients requiring arterial blood sampling; however, it did not affect the success of arterial blood sampling.

It is worth mentioning that the implementation of this study coincided with the spread of the COVID-19 pandemic in Iran, which both limited and facilitated the effect of the study. Therefore, the blood sampling in this study was carried out with delay at the beginning due to the focus of hospital care activities on COVID-19 patients. However, after the relative stabilization of hospital conditions and the start of sampling, COVID-19 patients were the only group of patients who were referred to the hospital; therefore, they were the only participants in this study. Moreover, since COVID-19 patients had lung disease, they often needed arterial blood sampling. This facilitates the researchers' access to the eligible participants with inclusion criteria. However, this issue may have affected the results of the study, which makes it difficult to generalize the results.

Implications for Practice

According to the obtained results, it can be concluded that Hugo point massage with ice can reduce the pain and anxiety caused by arterial blood sampling. Therefore, Hugo point massaging with ice before arterial blood sampling is suggested to be used as an available, efficient, and cost-effective method in nursing care programs.

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Conflicts of Interest

The authors declare that they have no conflict of interest regarding the publication of the present study.

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