ORIGINAL ARTICLE

The Effect of Foot Reflexive Massage on the Physiological Indexes of Cerebrovascular Accident (CVA) patients

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ABSTRACT

Background: By improving blood circulation, reflexive massage relaxes muscles and stimulates the parasympathetic nervous
Aim: To explore the effect of foot reflexive massage on physiological indicatorsofcerebrovascular accident (CVA) patients.
Methods: This study is a clinical trial that was performed on 60 CVA patients in the neurology department of Ali Ibn Abi Talib Hospital in Rafsanjan. The participants were selected through convenient sampling based on the inclusion criteria and then were placed into the two control and intervention groups using random minimization classification. The participants in the intervention group received foot reflexive massage, while the members of the control group received a simple foot sole massage for a 15-minute session for both feet. The data were collected using the demographic information questionnaire and the physiological index registration form immediately before the intervention and 10 and 30 minutes after the intervention and were analyzed with SPSS18 software using independent samples t-test, chi-square test, Fisher's exact test, and a two-way repeated-measures ANOVA.
Results: The results showed that systolic and diastolic blood pressure and heart rate had a statistically significant decrease in the intervention group ($p < 0.05$). However, there was no statistically significant difference for the participants in the control group in terms of blood pressure and heart rate. Furthermore, there was no significant difference between the two groups in terms of temperature changes, respiratory rate, and oxygen saturation($p < 0.05$).
Conclusion: Based on the findings of this study, foot reflexive massagecan be used to reduce systolic and diastolic blood pressure and heart rate in CVA patients.
Keywords: Ischemic stroke, Reflexive Massage, Physiological Indicators

INTRODUCTION

Cerebrovascular accident (CVA) is one of the leading causes of disability in adults and continues to be a major public health problem. CVA accounts for a large proportion of nervous system disorders, and studies have predicted that by 2020, the cerebrovascular accident will be changed from the six leading cause to the fourth leading cause of disease burden. The disease is the second leading cause of death in the United States, with 4.7 million outbreaks in the United States, with an estimated cost of $ 57.9 billion a year[1,2]. A sudden increase in CVA cases and related costs are expected in Western countries from 2010 to 2030[3], resulting in severe disability[4].

If the blood flow to a part of the brain is stopped, that part is notable to function normally. This condition is called a cerebrovascular accident (CVA). There are generally two types of cerebrovascular accidents: ischemic stroke and hemorrhagic stroke. If a blood vessel is blocked by a blood clot, it can lead to an ischemic stroke, and if a blood vessel ruptures in the brain and blood leaks into the brain tissue, a hemorrhagic stroke can occur[5]. An ischemic stroke can cause several neurological defects and complications depending on the location and extent of the affected tissue, ranging from mild and transient complications such as blurred vision to permanent paralysis or even death[6].

In order to survive and achieve long-term outcomes, the blood supply to brain tissue is important and vital. Therefore, when taking care of CVA patients, the blood supply to the brain tissue should be considered as the first priority, and even after the critical stages, continuous monitoring is needed. The most important symptoms of decreased blood flow to the brain are bradycardia, changes in breathing pattern, decreased blood pressure, altered level of consciousness, headache, and vomiting[7]. In the first few days after an acute ischemic stroke, a rise in temperature was reported in half of the patients, indicating poor prognosis. Harmful effects of the initial increase in body temperature have been attributed to an increase in the body's metabolic needs, such as changes in cerebrospinal fluid permeability[8]. Controlling vital signs provides information about the client's normal conditions. Changes in vital signs can indicate changes in physiological functions, so monitoring hemodynamic status and physiological indicators in CVA patients is a routine and vital practice[9].

There are many treatments available including complementary medicine techniques that nurses can use to help patients improve their health. Reflexive massage is a

comprehensive approach and nursing intervention that supports traditional care[10]. In recent years, the use of reflexive massage methods in medical units has increased, and institutions are widely using reflexive massage to treat and help patients. Foot reflexive massage is one of the treatments available in complementary medicine and belongs to the group of manual massage therapies and is one of the six most widely used methods in complementary and alternative medicine in Norway, Denmark, and the United Kingdom[11]. Foot reflexive massage has a long history. It has existed in Egypt since about 2330 thousand years ago and in ancient China four thousand years ago. Reflexive massage is based on the idea that each of the body's organs has a corresponding reflexive area in the soles of the feet, hands, and ears. The founder of foot reflexive massage, Younes Ingham, believed that massaging these areas using unique techniques would increase the blood flow to the organs at each point in the foot.

Complementary therapy, unlike pharmacological treatments, has no serious or economic complications and is simple and acceptable for the patient[12]. Paying attention to complementary therapies in nursing, as they can be done without a doctor's prescription, provides a way for the professional independence of nurses. Adding a reflexive massage to nursing skills increases the possibility of comprehensive care[13]. Reflexive massage is massage applied in certain areas of the body that can be useful in relieving pain[14] and eliminating physiological disorders as well as specific complaints and causes peace and relaxation in different parts of the body and one of the advantages of this massage is that it is cheap and comfortable and increases the family's cooperation in care without the need for special equipment[13].

Reflexive massage improves blood flow, relaxes muscles and stimulates the parasympathetic nervous system[15], and by stimulating the vagus nerve, reducing cortisol and norepinephrine, and increasing serotonin can be effective in improving physiological characteristics[16]. However, some studies such as Ernst's review articledo not provide convincing evidence for the effectiveness of reflexive massage in treating medical conditions[16].

Several studies have examined the effects of reflexive massage, including the effect of reflexive therapyon blood pressure, triglycerides, and blood sugar[17], improving anxiety in patients undergoing chemotherapy[18], reducing depression, and improving the function of the immune system[19], pain relief[20], and fatigue reduction However, these studies have presented conflicting results and some have considered reflexive massage as effective and some as ineffective. For example, Shaban et al. conducted a study entitled "Immediate effect of foot massage on the vital signs of patients hospitalized in the general intensive care unit". They selected 50 patients using convenient sampling. The patients' physiological indicators (heart rate, mean arterial pressure, and blood oxygen saturation were recorded for 5 minutes (once every minute) on the monitor, then the feet were massaged for 5 minutes by the researcher, and vital signs were recorded immediately after the intervention for 5 minutes. The results of the study showed that massage is not effective on the vital signs of patients hospitalized in the general intensive care unit[22]. Mohammadpour et al. examined the effect of reflexive massage on blood pressure of 68 patients with cerebrovascular accidents who were selected using convenient sampling and randomly divided into two groups. In the intervention group, blood pressure was measured and recorded by the researcher 10 minutes before the intervention, and the massage was performed for 30 minutes for each patient. The patients' blood pressure was measured again immediately, 10 minutes, and 20 minutes after the intervention. The participants in the control group received no intervention. The results of the study suggested that foot massage is effective in the vital signs of patients with cerebrovascular accidents[2]. Given the contradictory findings of the previous studies in the literature, the prevalence of cerebrovascular accident, and the fact that the use of foot reflexive massage causes emotional and psychological communication between the nurse and the patient, the authors of the present study were motivated to explore the effect of foot reflexive massage on the physiological characteristics of CVA patients admitted to Ali Ibn Abi Talib Hospital in Rafsanjan in 2018.

METHODOLOGY

This randomized clinical trial study was conducted in 2018 on 60 CVA patients admitted to the neurology department of Ali IbnAbiTalib Hospital in Rafsanjan. The patients were selected through convenient sampling based on the inclusion criteria and then were placed into the two control and intervention groups using random minimization classification. The process for selecting the participants started after the approval of the research project by the Research Council of Rafsanjan University of Medical Sciences under the code of ethics REC.1397.020) and registration in the Iranian Registry of Clinical Trials under number IRCT2018030304038936N3. The sample size was estimated to include 24 persons for each group based on a study by Mohammadpour et al. and using the following formula. However, given the dropout rate, 30 persons were considered for each group.

$$n_1 = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \times \left(\sigma_1^2 + \frac{\sigma_2^2}{k}\right)}{\Delta^2}$$

$n_2 = k \times n_1$ $\beta = 0.10 \rightarrow Z_{1-\beta} = 1.29$ α=0/05 $Z_{1-\frac{\alpha}{2}} = 1.96$ σ_1= 0.69

Where σ_1= 0.69 is the standard deviation of temperature measured 30 minutes after the intervention for the participants in the intervention group, σ_2= 0.81 is the standard deviation of temperature measured 30 minutes after the intervention for the participants in the control group, K = 1 is the sample size in the two groups under study, and Δ = 0.7 is the minimum difference in average temperature which is clinically significant.

The inclusion criteria were the willingness to participate in the study, definitive diagnosis of cerebrovascular accident, having the level of consciousness based on the Glasgow Coma Scale (GCS) of above 7, being over 30 years old, having no cardiac arrhythmia, having a heart rate more than 60 beats per minute, having a temperature above 36.5 °C, having systolic blood pressure above 90, having not sensitivity in the foot and not suffering from vascular disorders in the foot, lack of amputation of the lower limbs, having no wounds, infections, and skin diseases in the foot, not taking medications such as nitroglycerin, dopamine, and dobutamine, having no history of mental illness, no suffering from osteoporosis, and not having neurological diseases. The exclusion criteria wereunwillingness to participate in the study, not tolerating the intervention, and having acute and critical conditions during the intervention. The data were collected using two forms[1]: The demographic information questionnaire and information about the disease including ten questions and(2) a form for recording physiological indicators at different times (10 minutes before the intervention, immediately after the intervention, 10 minutes later, and 30 minutes after the intervention). The instruments used in the study were a digital thermometer (Easy life), a blood pressure monitor (Easy life Aplicado 300, Japan),a stethoscope (NMC-S-20, China), and a pulse oximeter(PC-66B, China) to measure heart rate and the oxygen saturation of arterial blood. Also, the number of patient breaths was counted and recorded by another researcher by observing chest movements per minute. Before starting the intervention, the participants were examined by a neurologist, and the necessary explanations about the research project were provided to the patients who met the inclusion criteria, and they completed a consent form. Then, the researcher and a male assistant who completed reflexive massage training performed the massage intervention for the participants according to their sex. It should be mentioned that the researcher had completed a reflexive massage training course in Tehran under the supervision of the National Massage Association of IRI and obtained the relatedcertificate. Thephysiological indicators (heart rate, respiratory rate, temperature, oxygen saturation, and blood pressure) of the participants in the intervention group were measured and recorded 10 minutes before the start of the intervention by another researcher. The validity of the devices was also confirmed by receiving a calibration certificate, and the measures related to participants were further checked and approved by two experts.

Prior to the intervention, the researcher examined the patient's foot for skin conditions, and after performing a general reflexive massage, specialized reflexive massagewas performed pressing the important reflexive points of the foot sole such as the solar plexus and the points related to pituitary, spinal cord, spine, pelvis, and limbs by using the thumb and forefinger. Foot reflexive massage was performed first on the left foot and then on the right foot for 30 minutes (15 minutes for each foot). To do so, the participants were asked to lie on the bed in a relaxed state and close their eyes. After massaging the foot, the foot heel was held with the left hand and the foot was dipped from the ankle by applying pressure to the foot sole. Then, the pressure was applied directly by the thumb on the solar plexus of each foot for 15 minutes (6 minutes of pressure, 3 minutes of rest, and 6 minutes of pressure). To this end, the pressure of 3-4 kg was applied circularly on the second day (Figure 1). The participants in the control group were treated by simple foot massage without compressing the standard points with the same conditions and time for the intervention group. Immediately after, 10 minutes and 30 minutes after the intervention, the participants' temperature, heart rate, blood pressure, respiratory rate, and oxygen saturation of the arterial blood were checked and recorded by the researcher. Finally, the collected data were analyzed with SPSS 18 software through the independent samples t-test, chi-square test, Fisher's exact test, and a two-way repeated-measures ANOVA at the significant level of 0.05 ($p<0.05$).

RESULTS

The participants in this study were 60 CVA patients (30 persons in the intervention group and 30 persons in the control group). The average age of the participants in the intervention and control groups was 65.800±12.642 and 68.566±13.800, respectively. There was no significant difference between the two groups in terms of age ($p = 0.623$). Besides, the analysis of the participants' demographic data showed that the two groups did not show statistically significant differencesin terms of demographic characteristics (Table 1).

To evaluate the time effects (changes in mean heart rate, systolic and diastolic blood pressure through repeated measurements over time), group effects (the changes in the mean scores through repeated measurements over time) and time-group interaction (changes in mean heart rate, systolic and diastolic blood pressure over time by taking into account the effect of groups), a two-way repeated-measures ANOVA was used. The results of the multivariate test showed that the effect of time-group interaction ($p<0.01$) as well as the time effect was statistically significant ($p<0.01$). Besides, the results of the between-subject effect test to examine the group effect suggested statistically significant differences ($p<0.01$). Therefore, statistical modeling was used to provide a detailed analysis of the time-effect interaction and the trend of changes in mean heart rate, systolic, and diastolic blood pressure in different groups and times.

The results of the independent samples t-test showed that mean heart rate and systolic and diastolic blood pressure were not significantly different between the two groups before the intervention ($p <0.05$). besides, as shown in (Table 2), the time to measure the mean heart rate and systolic and diastolic blood pressure has a significant effect ($p<0.01$). Accordingly, it can be suggested that regardless of group membership, there is a significant difference between the scores of the research variables ten minutes before the intervention, immediately after the intervention, and ten and thirty minutes after the intervention.

The time-group interaction effect was also significant ($p <0.05$), which shows that the rate of decrease in the mean heart rate and systolic and diastolic blood pressure in the intervention group are significantly higher than the control group. This implies the significant effect of the

intervention on the number of heartbeats, systolic blood pressure, and diastolic blood pressure. The group effect is also significant on the mean score of the research variables, showing that regardless of the time of measurement, there is a significant difference between the mean scores of the research variables in the intervention group and the control group ($p<0.01$).

Table 1. A comparison of the absolute and relative distribution of the participants in the two groups according to their demographic characteristics

Variable		Intervention		Control		Frequency		P-value
		Number	%	Number	%	Number	%	
Gender	Male	15	48.4	16	51.6	31	100	0.796
	Female	15	51.7	14	48.3	20	100	
Marital status	Single	2	40	3	60	5	100	0.640
	Married	28	50.9	27	49.1	55	100	
Education	Illiterate	17	53.1	15	46.9	32	100	0.689
	Primary school	7	41.2	10	58.8	17	100	
	Diploma	6	45.5	5	45.5	11	100	
Income	< 20 million Rials	24	48	26	52	50	100	0.488
	20-40 million Rials	6	60	4	40	10	100	
Job	Farmer	5	62.5	3	37.5	8	100	0.718
	Employee	6	40	9	60	15	100	
	Housewife	12	54.5	10	45.5	22	100	
	Self-employed	7	46.7	8	53.3	15	100	
History of coma	Yes	1	33.3	2	67.7	3	100	1
	No	29	50.9	28	49.1	57	100	
Type of stroke	Hemorrhagic	2	40	3	60	5	100	1
	Ischemic	28	50.9	27	49.1	55	100	
Number of strokes	None	11	44	14	56	25	100	0.420
	Once	11	47.8	12	52.2	23	100	
	Twice	8	66.7	4	33.3	12	100	
Smoking habits	Yes	11	52.4	10	47.6	21	100	0.787
	No	19	48.7	20	51.3	39	100	

Table 2: A comparison of the mean scores (heartbeats and systolic and diastolic blood pressure) in the studied groups at different times

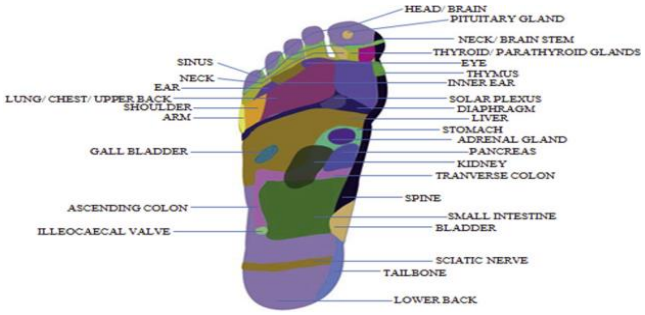
Variable	Intervention time	Intervention group	Control group	Two-way repeated-measures ANOVA						
		Mean ± SD	Mean ± SD	Source of changes	Sum of squares	Mean squares	df	F	Effect size	P-value
Number of heartbeats	Before the intervention	76.67±8.69	74.77±10.57	Time	38.946	2.284	17.054	3.193	0052	0.038
	Immediately after the intervention	76.50±8.56	74.20±10.21	Time-group	54.413	2.423	22.454	4.461	0.071	0.01
	10 minutes after the intervention	75.77±8.80	74.60±10.40							
	30 minutes after the intervention	74.50±8.44	74.70±10.58							
Systolic blood pressure	Before the intervention	139.68±22.08	137.43±16.73	Time	1667.533	1.702	979.762	14.238	0.0197	0.001
	Immediately after the intervention	135.83±21.23	136.53±17.061	Time-group	946.733	1.702	556.255	8.084	0.122	0.001
	10 minutes after the intervention	129.43±20.62	136.20±17.25							
	30 minutes after the intervention	128.73±19.92	135.77±13.92							
Diastolic blood pressure	Before the intervention	81.63±1.23	80.43±7.68	Time	958.850	1.893	506.603	34.979	0.376	< 0.0001
	Immediately after the intervention	80.20±9.76	79.73±7.26	Time-group	342.267	1.893	180.844	12.486	0.177	< 0.0001
	10 minutes after the intervention	75.87±9.76	78.80±7.54							
	30 minutes after the intervention	73.73±18.19	78.33±7.42							

The results of the Bonferroni test showed that the changes in the number of heartbeats in ten minutes before, immediately after the intervention, and ten minutes after the intervention was significantly different from the number of heartbeats thirty minutes after the intervention ($p <0.05$). However, there was no statistically significant difference in the number of heartbeats of the participants in the control group between the three stages.

Similarly, the results of the Bonferroni test suggested that the changes in diastolic blood pressure were significantly different for the participants in the intervention group in all three stages except for the diastolic blood pressure ten minutes before and immediately after the intervention ($p <0.00001$). However, there was no statistically significant difference in diastolic blood pressure of the participants in the control group between three stages.

Finally, the results of the Bonferroni test indicated that the changes in systolic blood pressure were significantly different for the participants in the intervention group in all three stages ($p < 0.05$). In contrast, there was no statistically significant difference in systolic blood pressure of the participants in the control group between three stages.

Also, the results of the two-way repeated-measures ANOVA showed that the changes in temperature, respiratory rate, and blood oxygen saturation in the two groups were not statistically significant ($P < 0.05$).



(Figure-1)

DISCUSSION

To meet the needs of patients, caregivers or even patients themselves are looking to find other treatments besides pharmacotherapy. Patients may believe in complementary and alternative medicine therapies and choose them because of beliefs inherited from the past. According to medical experts, if complementary medicine is not scientifically proven, it should not be used as a care and treatment strategy (24). The results of the present study suggested that apart from blood pressure and heart rate, there was no significant difference in the number of breaths, temperature, and oxygen saturation of arterial blood after foot reflexive massage. Khoshtrash et al. found that 30 minutes of foot reflexive massage in two sessions with an interval of 24 hours in women after cesarean section did not significantly affect physiological indicators including blood pressure, heart rate, and respiratory rate[25]. These findings are in conflict with our results concerning blood pressure and heart rate. The difference in results is probably due to the fact that Khoshtrash et al. did not considerthe solar plexus, while the present study consideredthe solar plexus massage. Moeini et al. showed that the mean systolic and diastolic blood pressure in patients before coronary artery bypass grafting in the experimental group had a statistically significant difference after the use of reflexive foot massage, which was significant between the two groups. However, heart rate and respiratory rater after foot reflexive massage in the experimental group did not show a significant difference[26].

Jones et al. also found that massaging the upper half of the sole of the left foot in healthy persons altered cardiac indicators such as heart rate, systolic anddiastole blood pressure, and mean arterial pressure[27]. Kaur et al. showed that foot reflexive massage significantly reduced systolic blood pressure, increased diastolic blood pressure, decreased heart rate, and improved oxygenation in critically ill patients in intensive care units[28].

Valiani et al. found that foot reflexive massagefor 15-05 minutes in postpartum women resulted in a significant difference in systolic and diastolic blood pressure[29] and foot reflexive massage was effective in reducing patients' blood pressure after abdominal surgery[30]. Another study by Howangsuvannakor and McVicar showed that foot reflexive massage significantly reduced systolic blood pressure in healthy individuals but did not significantly alter their diastolic pressure[31]. Won et al. also showed that foot reflexive massage significantly reduces systolic and diastolic blood pressure in patients undergoing chemotherapy, which is consistent with the results of the present study[32]. Padial et al. also concluded that foot reflexive massage increases diastolic and systolic blood pressure[33]. Wilkinson et al. performed foot reflexive massagefor 20 patients with chronic obstructive pulmonary disease in two experimental and control groups. They concluded that foot reflexive massage had no effect on blood pressure[34]. In another study Mirzaei et al. performed foot reflexive massage for primiparas women and showed no significant difference between control and intervention groups in terms of changes in systolic and diastolic blood pressure[35]. Hatan et al. investigated the effect of foot massage and guided relaxation in patients undergoing heart surgery and showed that foot massage has no effect on any of the physiological indicators[36]. Similarly, a study by Park et al.showed that foot reflexive massage did not have a significant effect on diastolic blood pressure, which is not consistent with the results of the present study[37]. However, the results of a study Kaur et al. on the effects of reflexive massage on physiological indicators of critically ill patients in ICU indicated that that massage increased the patients' diastolic blood pressure[28], which is inconsistent with the results of the present study. These contradictory results are probably due to differences in the research samples, techniques, depth and strength, the area where foot reflexive massage was applied, and more importantly the nature and type of the disease and its different mechanisms in patients with different diagnoses. In the present study, reflexive massage was performed in the solar plexus of the foot. Reflexive massage improves blood flow, relaxes muscles, and stimulates the parasympathetic nervous system[15]. It also stimulates the vagus nerve, reduces cortisol and norepinephrine, and increases serotonin and thus can be effective in improving physiological indicators[16].

CONCLUSION

The results of the present study suggested that foot reflexive massage has blood pressure lowering effects. Therefore, this finding is of clinical importance in nursing care because reducing blood pressure without the use of medication is an important goal of care and can reduce the side effects associated with medications. Therefore, given to the results of the present study and since the teaching of this technique by nurses to patients and their families is simple, also considering the high prevalence of cerebrovascular accident, low cost of the reflexive massage and the absence of complications or side effects

associated with reflexive massage, the training, and application of this method is recommended for medical staff, especially nurses. Unfortunately, massage is less popular today for a variety of reasons, including time constraints, lack of manpower, use of superior technologies, and increased complexity of care. The findings of this study could be a prelude to further research. Given that the effects of foot reflexive massage in this study were controlled only up to 30 minutes after the intervention, it is recommended that more studies be performed on the effect of foot reflexive massage in the long run.

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Ethics in Publication: The protocol of the effect of foot reflexive massage on the physiological characteristics of CVA patients was approved by the Ethics Committee in the Research of Rafsanjan University of Medical Sciences under No. IR.RUMS.REC.1397.020 and was registered in the Iranian Registry of Clinical Trials under number IRCT20180303040389 36NN3.

Conflict of interest: There is no conflict of interest in this study.

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