

# The effect of acupressure on muscle cramps in patients undergoing hemodialysis

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## ABSTRACT

**Background:** Pain resulting from muscle cramps is one of the most common outcomes of hemodialysis. One of the mechanisms associated with muscle cramps is unnatural muscle metabolism. Because acupressure improves muscle metabolism through the releasing of energy, this study was performed with the purpose of determining the impact of acupressure on muscle cramps.

**Materials and Methods:** This study was a single-blind clinical trial. Accordingly, 64 patients were selected and intensity and frequency of muscle cramps were determined by randomly categorizing them into two groups. The intervention group received 9 sessions of acupressure and the control group received 9 sessions of placebo intervention. The intervention was performed 15 min before hemodialysis in both groups. In both the groups, average intensity of pain and the frequency pain was compared before, after, and 1 month after completion of the intervention.

**Results:** Data analysis revealed that there were no significant statistical differences between the two groups in terms of mean value of intensity ( $P = 0.586$ ) and frequency ( $P = 0.780$ ) of muscle cramps before the intervention. We observed a significant difference after completion of intervention sessions ( $P < 0.001$ ). Moreover, there were no significant differences between mean value of intensity ( $P < 0.001$ ) and frequency ( $P = 0.030$ ) of muscle cramps in the control group before, after, and 1 month after the completion of 9 sessions of placebo intervention.

**Conclusions:** Employing acupressure may result in decrease of muscle cramps in patients undergoing hemodialysis.

**Key words:** Acupressure, hemodialysis, Iran, muscle cramps

## INTRODUCTION

The most common physical symptom that hemodialysis patients suffer from is muscle cramps that often occur during and between dialysis sessions.<sup>[1]</sup> Muscle

cramps have been reported in 55% to 60% of the patients.<sup>[2]</sup> Muscle cramps are one of the seven main symptoms that patients undergoing hemodialysis treatment experience. Cramps affect the legs, especially the calves, arms, hands, and the abdominal muscles.<sup>[3]</sup> This condition is not a dangerous phenomenon, but it is aggravating for the patient and often forces the nurses to separate the patients from the dialysis machine sooner than required.<sup>[4]</sup> This issue decreases the quality of the dialysis for the patients and reduces their quality of life (QOL).<sup>[5]</sup> Most of these patients become critically ill due to inadequate dialysis and are admitted to the hospital, and thus, increase the workload of the health system. This condition also makes the dialysis process an inconvenient experience for the patients and causes the patients to discontinue the dialysis program.<sup>[6]</sup> Thus, the prevention of this symptom is considered to be one of the major challenges for dialysis personnel.<sup>[4]</sup>

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Different hypotheses have been proposed regarding the physiopathology of muscle cramps in these patients but the etiology of cramps is unknown.<sup>[1]</sup> Therefore, its treatment is challenging. One of the assumptions that underlie the emergence of muscle cramps in these patients is abnormal muscle metabolism.<sup>[7]</sup> Often, the preferred treatment for reducing muscle cramps caused by hemodialysis is vitamin E intake.<sup>[8,9]</sup> However, vitamin E interferes with anticoagulants such as heparin used in these patients, and, given that most drug metabolites are excreted through the kidneys, it increases the risk of drug toxicity in these patients.<sup>[10]</sup> Therefore, due to the drugs' side effects, the costs imposed on family economy, and the health impacts, application of nondrug treatments are considered. According to Chinese beliefs, acupressure can release the mediated neurons in the central nervous system,<sup>[11,12]</sup> improve muscles metabolism, reduce the pain caused by muscle cramps, and comfort the patients.<sup>[13]</sup> Based on reports by researchers including Snyder, acupressure is an intervention with the highest application by nurses in clinical settings.<sup>[14]</sup>

Numerous studies have been conducted to investigate the effectiveness of acupressure on the problems of patients with end-stage kidney failure and have obtained different results. A study was conducted to evaluate the effect of acupressure on the sleep quality of 47 patients undergoing hemodialysis.<sup>[15]</sup> It showed that acupressure treatment group, compared with the control group, had significantly benefited from the improvement of sleep quality.<sup>[15]</sup> The effect of acupressure on fatigue and itching in patients undergoing hemodialysis in 2013 was studied by Sabouhi *et al.*<sup>[16]</sup> and Kilic Akca *et al.*,<sup>[17]</sup> respectively. Their findings showed a significant reduction in itching and fatigue in these patients.

In some studies, conflicting results have been observed. In a systematic study, Kim *et al.* reviewed 86 studies from 2009 to 2010 on the role of acupressure in controlling the symptoms of end-stage kidney failure and analyzed 7 studies and compared the benefits of acupressure with other treatments.<sup>[18]</sup> In many cases, acupressure did not have any impact on controlling the complications. Thus, researchers required further studies to set clear standards for evaluating the efficacy and safety of acupressure in these patients.<sup>[18]</sup> On the other hand, the majority of dialysis nurses' activities are carried out in the absence of medical doctors. Therefore, dialysis nurses should be able to detect problems caused by chronic renal failure and the impact of nondrug treatment alternatives and appropriate nonpharmaceutical measures for these patients.<sup>[19]</sup> Reduction of muscle cramps in these patients can result in the compliance of patients with hemodialysis, and by increasing the adequacy of the dialysis, these patients' QOL will also increase. This will also reduce concerns regarding a nondrug approach to reduction

of muscle cramps. Therefore, this study aimed to determine the effects of acupressure on severity and frequency of muscle cramps in patients treated with hemodialysis.

## MATERIALS AND METHODS

This was a single-blind clinical trial with the project code 393481. The study included an intervention group and a control group. It was conducted at Alzahra, Hojjatieh, and Amin Hospitals in Isfahan, Iran, in October 2014 after obtaining the approval of the university ethics committee. Convenient sampling method was used in the present study. The inclusion criteria included patients with chronic kidney failure who were treated with hemodialysis; had a history of frequent muscle cramps; were not in the transplant list at the time of sampling; were dialyzed by bicarbonate dialysis<sup>[3]</sup> three times a week, each lasting 4 hours,<sup>[10]</sup> a minimum of 6 months had passed since the beginning of their dialysis;<sup>[20]</sup> did not have a history of diabetes, smoking and alcohol,<sup>[10]</sup> infectious diseases, skin diseases, acute articular rheumatism,<sup>[21]</sup> open leg wounds, fractures, burns, deep vein thrombosis of the extremities,<sup>[20]</sup> and arm or leg amputation; and were not using specific anticramps medications such as vitamin E and painkillers. The participants completed an informed consent and were able to willingly withdraw from the study at any stage. If the patient underwent transplant surgery, the number of dialysis sessions changed,<sup>[16]</sup> or treatment with anticramps medications or painkillers began, they were excluded from the study.<sup>[4]</sup>

Background information including age, gender, and duration of hemodialysis therapy were recorded in the questionnaire using patient records. Numerical scale for pain intensity of muscle cramps and a researcher-made questionnaire for reporting the frequency of muscle cramps in a day was distributed among the participants. The reliability of the numerical pain scale was calculated in Iran in 2008 as  $r = .96$  by Yaghoobi *et al.* using Pearson correlation coefficient between two stages of evaluation and the validity of this tool was obtained using content validity.<sup>[10]</sup> Considering that muscle cramps in these patients occurred mostly in the legs and feet, hands, arms, and the abdomen, in both groups, the B57, GV26, LV3, CV4, CV6, K1, LU7, LU9 points were selected for acupressure. These points were located on the energy channels of these body parts causing the flow of life energy in these areas. Point K1 was located at the sole of the foot along an imaginary line between the second and third toe. Point GV26 was located at the base of the teeth placed between the upper lip and the nose. Point LV3 was located between the biggest toe and the second toe of each foot. CV6 point was located at the center of the abdomen about two finger widths below the navel. CV4 point was located at the center of the abdomen

about 4 finger widths below the navel. The LU9 point was located at the right side of the wrist where the pulse of the radial artery was felt. LU7 point was located two fingers above the wrist on the palm just outside the radial bone. The B57 point was located at the middle of the calf at the connection of the muscles and tendons.<sup>[22]</sup>

The researcher and his colleagues received training on acupressure under the supervision of an experienced instructor who had experience in the field of complementary medicine and was approved by the university and faculty members. After completing the course, their performance on acupressure was evaluated by the professor. Their competence in performing acupressure was confirmed after they had correctly carried out all the steps in terms of determining points of pressure, duration of the pressure, and the intensity of the pressure, within the specified duration. The amount of pressure on the points by both hands of the researchers was confirmed using a standard scale after 40 repetitions with an average of 3 to 4 kg on the scales with 100% accuracy. Acupressure was performed for the control group on placebo points near the main pressure points.<sup>[16]</sup>

Variables such as blood pressure, pump rounds, and transmembrane pressure (TMP) amount affected the severity and frequency of muscle cramps. Therefore, dialysis was conducted for all patients using dialyzer containing 2 mEq per liter of sodium at 37°C. Patients were prohibited from eating before and during the dialysis in order to control the variables of hypotension. All the dialysis sessions were performed with TMP of 500 and pump round of 300 ml per minute.<sup>[10]</sup> Considering that the level of BUN, Cr, Na, PTH, and Ca of the patient's blood could cause muscle cramps, the impact of these factors on the results of the study were controlled by random selection of the samples.

After explaining the procedure, the subjects of the intervention group were placed in supine position.<sup>[23]</sup> Acupressure was performed on the main points of B57, GV26, LV3, CV4, CV6, K1, LU7, and LU9 15 min before the start of hemodialysis.<sup>[24]</sup> Each of these points were pressed for 2 min using the thumb.<sup>[25]</sup> The first minute after feeling the pulse, pressure was applied continuously and at the second minute pulsatile pressure was applied.<sup>[22]</sup> The pressure was enough to change the color of one third of the thumb nail to white. It is noteworthy that the paired points, such as LU9, LU7, B57, LV3, and K1, were pressed on both sides with both thumbs and the single points, such as GV26, CV4, and CV6, were pressed with the thumb of the right hand. In the control group, after describing the procedure and 15 min before the start of hemodialysis, the placebo points around the pressure points that were about 1 cm away from the pressure points were pressed.<sup>[16]</sup> These points

had no special name and very mild pressure was applied as placebo for 2 min. This intervention was performed for both groups for 3 weeks, 3 sessions per week, and each session lasted 16 min. After the end of 9 sessions of intervention<sup>[26]</sup> and 1 month after the intervention sessions,<sup>[27]</sup> the mean severity of pain due to muscle cramps and their frequency were recorded during 1 day. To analyze the data, Statistical Package for the Social Sciences software (version 18, SPSS Inc., Chicago, IL, USA), independent *t*-test, Chi-square test, and repeated measures ANOVA were used.

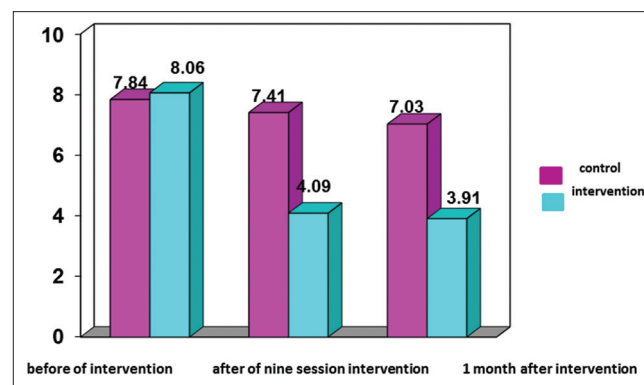
### Ethical considerations

Ethical properties of this study have been approved by Isfahan University of Medical Sciences.

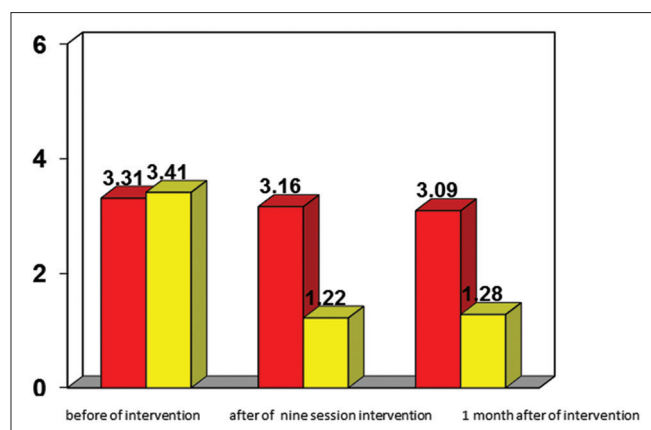
### RESULTS

In this study, Chi-square test results showed that there was no statistically significant difference between the frequency of gender distribution in the intervention and control groups ( $P = 0.802$ ). The results of *t*-test showed that there was no significant difference between the two groups in terms of mean age ( $P = 0.260$ ) and the duration of hemodialysis in months ( $P = 0.840$ ). Independent *t*-test results showed no statistically significant difference between the two groups in terms of the mean score of pain intensity of muscle cramps before the intervention ( $P = 0.586$ ). However, after 9 sessions ( $P < 0.001$ ) and 1 month after the completion of the intervention ( $P < 0.001$ ), this difference was significant [Figure 1]. Independent *t*-test results showed no statistically significant difference between the two groups in the mean frequency of muscle cramps before the intervention ( $P = 0.780$ ). Nevertheless, after 9 sessions ( $P < 0.001$ ) and 1 month after the intervention ( $P < 0.001$ ), this difference was significant [Figure 2].

The results of repeated measures ANOVA showed no significant different in the mean score of pain intensity



**Figure 1:** The mean score of pain intensity of muscle cramps in the two groups at different times



**Figure 2:** The mean number of episodes of muscle cramps in the two groups at different times

of muscle cramps ( $P = 0.230$ ) and the mean number of episodes of muscle cramps ( $P = 0.290$ ) in the control group before, after 9 sessions, and 1 month after the intervention sessions. However, in the intervention group, a significant difference was observed in the mean score of the intensity of muscle cramps ( $P < 0.001$ ) and the frequency of muscle cramps ( $P < 0.001$ ). Independent *t*-test results showed that a significantly higher rate of variation in the pain intensity score ( $P < 0.001$ ) and the number of episodes of muscle cramps ( $P < 0.001$ ) after 9 sessions of intervention and 1 month after the intervention sessions in the intervention group compared to the control group.

## DISCUSSION

This study aimed to determine the effects of acupressure on severity and frequency of muscle cramps in patients treated with hemodialysis. The control and intervention groups were similar in terms of background characteristics (age, gender, and duration of hemodialysis). The results of the intervention at the end of 9 sessions and 1 month after the intervention sessions significantly differed in terms of severity and frequency of muscle cramps. In other words, it can be said that applying acupressure caused reduction in the severity and frequency of muscle cramps in the intervention group compared to the control group.

Through searching the available websites, the researcher did not find any study that had examined the frequency of pain episodes. Most of the conducted studies had researched the pain caused by arthritis, labor, chronic low back pain, and menstrual pain, none of which were rhythmic. Most studies had been performed to investigate pain reduction and had not considered the frequency of pain episodes. However, muscle cramps frequently occur in patients treated with hemodialysis and the number of its episodes is of particular importance.

In line with the present study, Bastani *et al.* assessed the effect of acupressure on pain intensity in women with multiple sclerosis (MS), and showed that acupressure was effective in reducing pain intensity in patients with MS.<sup>[27]</sup> Moreover, the study by Masoudi *et al.* showed that acupressure in the intervention group, compared with the control group, had reduced the pain of intramuscular injection.<sup>[28]</sup>

Some experts believe that stimulation of points in acupressure prevents the transfer of acute stimuli and increases the level of endorphins in the blood, and thus, causes pain relief. In some studies, it was also shown that massaging the placebo points could cause varying degrees of release and relaxation in the body, and consequently, affect the pain of muscle cramps. However, the results of this study rejected this hypothesis. The results of studies by Ghareghi *et al.*<sup>[29]</sup> Kashafi *et al.*<sup>[30]</sup> Bazarganipour *et al.*<sup>[23]</sup> and Kim *et al.*<sup>[31]</sup> showed that acupressure reduced the pain intensity and duration of menstrual cramps.

Although the mechanism of action of acupressure is not precisely known, based on the available evidence, it seems that certain peptides are released as a result of acupressure and have multiple properties including anti-pain and can partly justify the mechanism of acupressure for pain control.<sup>[27]</sup> Hsing *et al.* studied the effect of 4 weeks of acupressure on lower back pain of 37 patients aged over 65 years and stated that acupressure can be used as an effective method for managing lower back pain in the elderly.<sup>[32]</sup> This result confirmed the results of the present study.

## CONCLUSION

According to the findings of researchers and the present study, pressure on B57, GV26, LV3, CV4, CV6, K1, LU7, and LU9 points reduced the frequency and severity of muscle cramps. Therefore, the use of acupressure to reduce the severity and frequency of muscle cramps is recommended to nurses of hemodialysis patients. Further research is recommended on the effect of acupressure on muscle cramps in patients undergoing hemodialysis with more acupressure sessions and the comparison of the results with other complementary medicine and medicinal procedures. Our sincere appreciation goes to Isfahan University of Medical Sciences and the authorities and staff of hemodialysis wards of Alzahra Hospital, Hojaatie Hospitals, and Amin Hospitals of Isfahan.

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### Conflicts of interest

There are no conflicts of interest.

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