

The Effect of Cryotherapy at the Hoku Point on the Severity of Pain of Fistula Catheterization in Hemodialysis Patients

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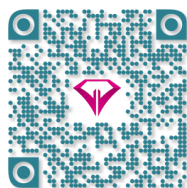
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ABSTRACT

Background & Objective: Pain is an unpleasant feeling that influences the quality of patients' life. Arteriovenous fistula catheterization pain can be reduced in hemodialysis patients with nonmedicinal and noninvasive methods of pain relief. This study aimed to investigate the efficacy of cryotherapy at the Hoku point on the severity of the pain of catheterization in hemodialysis patients.

Materials & Methods: This quasi experimental study was conducted on 40 hemodialysis patients selected by census sampling method. In the first session, intensity of arterial and venous puncture pain, without applying any intervention, was recorded using the visual analogue scale (VAS). In the second and third sessions before catheterization, ice cubes were placed on the Hoku point for 10 minutes and the intensity of pain of arterial and venous fistula was immediately measured. Data were analyzed using SPSS 19 by independent t-test.

Results: The mean score of pain in the first session (arterial: 5.97 ± 2.44 , venous: 6.00 ± 2.62) was compared with the mean score of pain in the second (arterial: 2.80 ± 1.92 , venous: 2.72 ± 2.09) and third sessions (arterial: 2.42 ± 1.72 , venous: 2.50 ± 1.93). The results of repeated measure analysis of variance showed that the mean score of pain significantly reduced in the second and third sessions compared to the first session ($P < 0.05$).

Conclusion: Cryotherapy at the Hoku point reduces the severity of pain of arteriovenous fistula catheterization and, thus, can be suggested as an effective noninvasive method for puncture pain relief in hemodialysis patients.

Keywords: Arteriovenous Fistula, Cryotherapy, Hemodialysis, Pain



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Introduction

The National Kidney Foundation (NKF) has classified chronic kidney diseases (CKDs) in 5 stages. The fifth stage or the end-stage occurs when the kidneys cannot repulse materials of body metabolism and the glomerular filtration rate (GFR) falls below 15 mL every minute; thus, the patient would need renal replacement therapy (RRT) for the rest of his/her life (1). In recent years, CKD has become a life-threatening condition, influencing all aspects of patients' life, including social and financial status, family, and the society at large. In the last few years, CKD has attracted great attention, particularly in developed countries (2). Patients at the end-stage of kidney disease need renal replacement therapy (RRT), including dialysis and kidney transplant, for the rest of their life. Dialysis is the most common method employed on these patients, owing to the shortage of kidneys available for transplant (3).

There are myriads of methods to access the arteries for chronic hemodialysis, including arteriovenous fistula, artificial grafts, temporary catheters without cuff, and permanent catheters with cuff (1). There are certain problems with arteriovenous fistula; however, it is the best method because it reduces mortality, has a lower prevalence of complication, lesser need for subsequent therapeutic intervention and hospital admission, a longer life span compared to other methods, and lower costs (4).

On average, patients with end-stage renal disease who undergo hemodialysis are frequently faced with stress and pain of 300 fistula punctures per year. Pain reduction may help the patients accept and continue their treatment, improving their quality of life (5). Kyle and Ricci (2009) have categorized pain management strategies to pharmacological and nonpharmacological

interventions. Nonpharmacological interventions include relaxation techniques, visual imagination, and cognitive behavioral strategies; biophysical interventions include acupressure, transcutaneous electrical nerve stimulation (TENS) combined with local heat or cold (6). Page and Taylor (2010) introduced pharmacological interventions such as applying local anesthetics before catheterization. EMLA (lidocaine 2.5% and prilocaine 2.5%) and Ametop (tetracaine 4%) require at least 45 minutes before their effects can be observed; however, this delay in catheterization is unacceptable in emergency wards (7).

Cutaneous stimulation for pain relief has been well explained by the "Gate theory", which can be combined with acupressure to increase its effectiveness (8). Acupressure is a branch of Chinese traditional medicine that stimulates acupuncture points by using pressure and massaging to accelerate and control body functions. This effect is achieved through the stimulation of energy channels (meridian) that are vital energy transmission routes in the body (9). The large intestine meridian or the Hoku point is one of the acupressure points (5) with a 2-way route (bilateral). It starts from the skin surface in the index finger, passes through the hand and arm, and goes to the end part of the shoulder. Then, the meridian leaves the skin surface to join the lower lung and transverse colon; next, it returns to the skin surface and the facial point next to the nostrils (8). The Hoku point, a large intestine meridian used in this study, is located between the first and the second bone of the palm, between the thumb and the index finger, and on the back of the hand (5). This point is easily reachable and stimulated by pressure, a needle, and extreme cold (10).

There are different strategies to alleviate pain in patients. Various studies have shown that using acupressure can relieve the pain intensity of dysmenorrhea (9,11). Cryotherapy is another simple and effective method for relieving the pain of catheterization (12). On the other hand, studies have indicated that cold effectively blocks neural conduction in neural pathways (13). Fang *et al.* (2012) showed that cryotherapy with ice cubes in a plastic bag is effective on patients undergoing arthroscopic surgery (14). Also, Fareed *et al.* (2014) found that cryotherapy is one of the most effective skin techniques for the pain relief of patients (8). Some studies have shown that massaging the Hoku point with ice can reduce pain during venipuncture in children with thalassemia (10) and can also reduce pain intensity of arteriovenous fistula catheterization in children undergoing hemodialysis (15).

Studies have shown that skin stimulation, as an independent nursing action, can reduce pain at the Hoku point, which is used to relieve the pain of the arms, hands, and shoulders. Also, cryotherapy at the Hoku point has been found to be effective for pain relief. Therefore, this study aimed to evaluate the effect of

cryotherapy at the Hoku point on catheterization pain in adult patients undergoing hemodialysis.

Materials and Methods

This quasi-experimental study that was carried out in 2018, examined the effect of cryotherapy at the Hoku point on arteriovenous fistula catheterization pain of hemodialysis patients. Patients with chronic renal diseases admitted to the dialysis unit of Emam Reza hospital in Sirjan (the only hospital with a dialysis unit in Sirjan) were selected to participate in this study. The sample size was 40 based on accessible patients. Although 50 patients were undergoing hemodialysis, 2 had mental disorders and 8 were not willing to participate; therefore, only 40 patients met the inclusion criteria, all of whom were evaluated by the census method.

The inclusion criteria of the study were as follow: age above 18; both female and male patients; awareness of place, time, and person; having the ability to verbally communicate; receiving hemodialysis through arteriovenous fistula; and willingness to participate in the study. The exclusion criteria were as follow: need to try for catheterization more than once; fracture and inflammation at the massage point; host patient; peripheral vascular disease; Raynaud's syndrome; diabetes neuropathy according to medical documentaries; use of painkillers within 24 hours before hemodialysis; and numbness of the puncture site.

The scale of the study had 2 parts:

- 1) Demographic features: age, sex, education, duration of dialysis, number of dialysis session per week, history of underlying disease, duration of using fistula, and duration of disease.
- 2) The visual analogue scale (VAS) of pain, which is a graded ruler from zero to 10, with zero representing the lower level of pain and 10 the higher level of pain. The VAS of pain is the easiest way to evaluate pain that can be easily understood by the patient (16).

The study was approved by Kerman University of Medical Sciences with code of ethics IR.KMU.REC.1395.286. Before the study, the goals and the process of the study were explained to the patients and informed consent was obtained.

Data were collected in 3 steps:

First Session: The demographic characteristics were collected by the researcher through interviews. AVF was performed by a nurse who was responsible for catheterization procedure. The researcher asked the patient to score the intensity of needling pain immediately after the AVF puncture of arterial and venous fistula separately using Visual Analog Scale for Pain (VAS).

Second Session: Ten minutes before catheterization of the fistula, 2 ice cubes wrapped in latex gloves were

placed on the back of the patient's other hand at the Hoku point (Figures 1 and 2). Then, the ice cubes were moved in circles with mild pressure for 10 minutes. Then, the nurse performed catheterization and the patient was supposed to score the pain immediately after AVF puncture of arterial and venous fistula separately using the VAS scale.

Third Session: The third session was done the same as the second session to ensure that every factor which could lead to fake results were controlled and the results were genuine.

Data were analyzed using SPSS 15 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were used to describe the demographic characteristics and cryotherapy-related factors in Hoku point. Ultimately, the effect of cryotherapy in Hoku point on reducing the pain of catheterization in hemodialysis patients was checked using repeated measure analysis of variance.

Results

The mean age of the patients was 57.78 ± 11.79 , and most of them were male (65%); 95% were married; 62.5% were illiterate; only 10% had academic education, and others had a high school diploma education level or less. Most patients (70%) received hemodialysis 3 times a week and others twice a week; duration of receiving hemodialysis was 32.38 ± 24.21

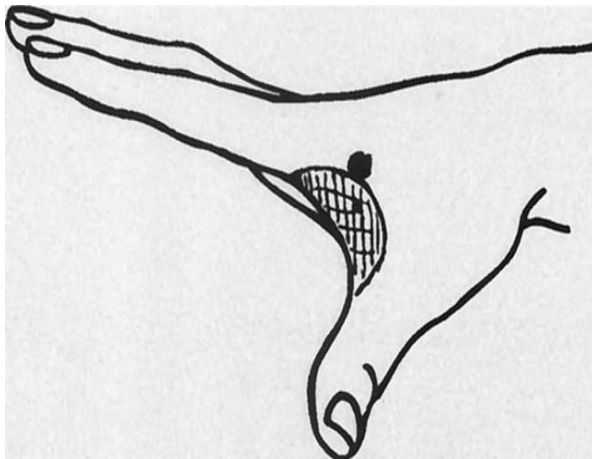


Figure 1. When the thumb and the index finger come together, they make a muscular peak at the Hoku point (17).

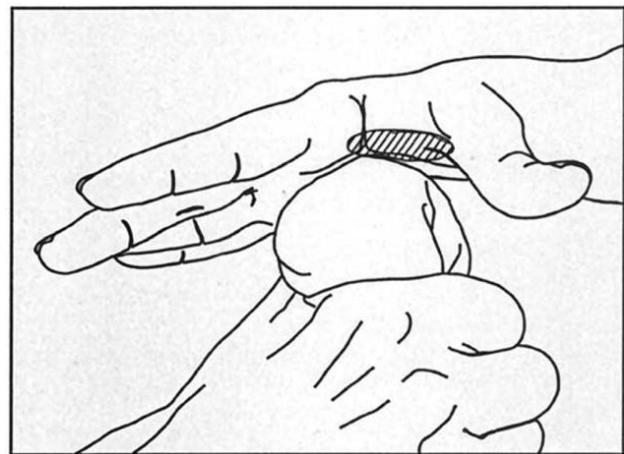


Figure 2. Cryotherapy at the Hoku point (17).

months and duration of disease in these patients was 62.78 ± 58.3 .

The mean score of pain of puncturing arterial and venous fistula in all sessions was compared separately using independent t-test; however, no significant difference was found between them ($P > 0.05$) (Table 1).

Then, the effect of cryotherapy at the Hoku point on reducing the pain of arteriovenous fistula catheterization was investigated using repeated measure analysis of variance. The results revealed a significant difference between the mean of the pain score of catheterizations before cryotherapy and the pain of catheterization in the second and third sessions in arterial ($F_{1, 37} = 77.95, P < 0.001$) and venous ($F_{1, 43} = 83.16, P < 0.001$) fistula. However, no significant difference was observed between the pain score and gender in arterial ($P = 0.31$) and venous ($P = 0.20$) puncture.

The results of pairwise comparisons using repeated measure analysis of variance (Bonferroni post hoc test) showed a significant difference between the mean score of arterial fistula puncturing pain in the first and second sessions and in the first and third sessions. However, no significant difference was found between the mean score of the pain of catheterization in the second and third sessions in arterial and venous fistula (Table 2).

Table 1. Comparison of the mean score of pain between arterial and venous puncture in 3 separate sessions

Variable	First session (without intervention)			Second session (with cryotherapy)			Third session (with cryotherapy)		
	Arterial fistula	Venous fistula	P-value	Arterial fistula	Venous fistula	P-value	Arterial fistula	Venous fistula	P-value
Mean score of pain	5.97±2.44	6.00±2.62	0.819	2.80±1.92	2.72 ±2.09	0.965	2.42±1.72	2.50±1.93	0.965

Table 2. Pairwise comparisons of the mean score of arterial and venous fistula puncturing pain by Bonferroni Post Hoc test

Parameter	First session (without intervention)	Second session (with cryotherapy)	Third session (with cryotherapy)	P-value
Arterial fistula	5.97±2.44	2.80±1.92	2.42±1.72	I-II: 0.00 I-III: 0.00 II-III: 0.36
Venous fistula	6.00±2.62	2.72±2.09	2.50±1.93	I-II: 0.00 I-III: 0.00 II-III: 0.23

Discussion

Pain during puncturing of arteriovenous fistula is a common problem in hemodialysis patients, which affects patients' quality of life (18,19). This study aimed to investigate the effect of cryotherapy at the Hoku point, as a nonpharmacological method, to reduce the pain of AVF in hemodialysis patients.

In the present study, the mean age of the patients was above 50 years, which was expected, as most of patients who suffer from chronic renal diseases are middle-aged. The patients were dialyzed for at least 2 years. However, the results of the statistical analysis did not show any significant relationship between catheterization pain and variables such as age, sex, education status, duration of dialysis, number of dialysis sessions, duration after AVF creation, and duration of the disease. Aghajanloo *et al.* (2016) found no significant relationship between pain score and age, duration of dialysis, and duration of AVF (5). Furthermore, Sabitha *et al.* (2008) found no significant relationship between the pain score with the duration of AVF and age. However, they remarked that women feel more pain than men (20). Figueiredo *et al.* (2008) indicated that the mean intensity of pain in women and men was different, but it was not significant (21). This little difference can be related to the pain threshold in females, which is lower than males due to sex hormones (22).

The results of this study indicated that applying cryotherapy at the Hoku point can reduce pain intensity of fistula puncture. Different studies have investigated the effect of cryotherapy at the Hoku point on reducing pain and provided useful results that are consistent with the results of the present study. For example, Pouraboli *et al.* (2015) showed that cryotherapy can be effective in reducing the pain of venipuncture in children with thalassemia (10). The first study that explored the effect of cryotherapy as a skin stimulation technique to reduce AVF puncture-related pain of dialysis patients was the work of Sabitha and colleagues (2008). They found that cryotherapy was effective in reducing the AVF puncture-related pain of dialysis patients (20). Furthermore, Hassan *et al.* (2012) performed a study on children undergoing hemodialysis and found the

same result; they suggested cryotherapy as a routine care before dialysis (15).

Patients undergoing hemodialysis are concerned about catheterization pain. The feeling of pain is not specifically limited to children; adults also mentioned catheterization as an unpleasant experience (23). In a study, 30% of patients expressed strong pain, 58.5% mild pain, and only 11.5% expressed low catheterization pain (24). Pain related to needle-puncturing is problematic when a person requires subsequent punctures (25). Therefore, pain relief is important for adults as well.

Davtalab *et al.* (2016) studied the effect of massaging the Hoku point with ice to reduce the pain of AVF catheterization in adult patients. They found that cryotherapy is effective in reducing the pain of AVF catheterization, which is consistent with the present study (12). Also, Aghajanloo *et al.* (2016) confirmed the positive effect of the aforementioned technique in pain relief and suggested this method to nurses to reduce the pain of catheterization (5).

Considering the patients' rights and the pyramid of Maslow's needs, pain relief is one of the fundamental needs of human beings (12). Pharmacological and nonpharmacological methods are used for pain relief. However, nonpharmacological methods are preferred. Studies have shown that skin stimulation is a nursing independent intervention that results in pain relief (8). Cryotherapy is an effective skin stimulation technique. It is cost-effective, has low complication, and is easy-to-use, and does not have complications like skin rash, skin erythema, and itches that are caused by local anesthetic drugs such as EMLA cream, lidocaine, and other drugs in the same category (7).

Since patients with kidney failure need frequent vascular access for dialysis, cryotherapy can be used as a nonpharmacological pain relief method with no complications in hemodialysis units. This method has been suggested to nurses in dialysis units for pain relief. It is also suggested that the pain relief effect of cryotherapy be compared with that of non-pharmacological interventions. One advantage of cryotherapy is that it can be performed by patients.

Considering the shortage of nurses and their lack of time, hemodialysis patients can be trained to use this technique.

Conclusion

Cryotherapy at the Hoku point as an independent nursing intervention and uncomplicated pain relief method, can reduce the severity of pain of arteriovenous fistula catheterization, thus, it can be suggested as an effective noninvasive method for puncture pain relief in hospitalized patients especially those undergoing hemodialysis.

Study Limitations

Despite the fact that VAS is a standard scale, perceived pain varies between individuals and is of a subjective nature.

The sample size was small due to the small number of patients in Sirjan. Thus, future studies should be conducted with larger sample sizes.

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Conflict of Interest

Authors declared no conflict of interests.

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