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ORIGINAL RESEARCH

The Effect of Body Acupressure on Blood Pressure and Fatigue Levels in Individuals Suffering From Hypotension During Hemodialysis: A Randomized Controlled Trial

Sevil Biçer, PhD; Sultan Taşci, PhD

ABSTRACT

Background/Aim • Since hypotension is one of the most common complications experienced during hemodialysis (HD), and there are studies indicating that stimulation of the P6 (Neiguan) acupuncture point affects blood pressure, this study examines the effect of acupressure performed on this point on blood pressure regulation as well as its effect on symptoms such as hypotension-associated fatigue and pain. This randomized controlled trial was conducted in order to determine the effect of 12-session body acupressure, performed by electrostimulation device, on blood pressure, headache, and fatigue level in individuals suffering from hypotension during hemodialysis.

Methods • The study was conducted with a total of 135 patients, including 67 patients in the intervention group and 68 patients in the placebo group at four hemodialysis centers located in two city centers. The data were gathered using a questionnaire, visual analog scale (VAS) for pain and fatigue, and the Piper fatigue scale. The forms were administered at the beginning of the application (first follow-up) and four weeks later (second follow-up). In the intervention group, the electrostimulation device was attached to the Neiguan (p6) acupuncture point and operated at the third hour of each dialysis session three times a week for one month. In the placebo group, the device was attached to the same acupuncture point but its batteries were removed and it was not operated. At the end of the four-week application, the forms were administered again. One-way analysis of variance, *t* test, Student-Newman-Keuls test, Pearson correlation analysis, Chi-square, McNemar test and McNemar Bowker test were used to assess the data.

Results • It was found that systolic and diastolic blood pressure levels were higher in all sessions in the intervention group compared to the placebo group ($P < .05$). In the first follow-up, no difference was observed between the groups in terms of the scores of VAS pain, VAS fatigue, and Piper fatigue scale ($P > .05$); whereas, in the second follow-up, it was determined that VAS pain scores, VAS fatigue scores, and affective, sensory, and total scores of the Piper fatigue scale decreased in the intervention group compared to the placebo group ($P < .05$).

Conclusions • As a conclusion; it was found that body acupressure, which was performed on the Neiguan (P6) acupuncture point using electrostimulation device, provided the systolic and diastolic blood pressure regulation and decreased VAS pain severity, VAS fatigue severity, and total score and subscale mean Piper fatigue scale scores. (*Altern Ther Health Med.* 2022;28(2):6-16).

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INTRODUCTION

Hypotension is one of the important complications most frequently encountered during HD and can restrict time and efficiency of dialysis.[1-3] Main predisposing factors for hypotension are lower body index (frequently in women), advanced age, diabetes mellitus, excess weight gain between dialysis sessions, and existing cardiovascular disease.[4-7] Although hypotension is seen in every session, ultrafiltration (UF) is frequently encountered during the last hours of dialysis session due to the removal of large amounts of fluid and solute from the body in a short time. Physical problems such as headache, dizziness, feeling unwell, absence, wooziness, nausea, vomiting, muscle cramps, fatigue, and exhaustion are also observed together with hypotension in recent hours in most of the patients.[5,8-11]

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In a qualitative study conducted on patients undergoing hemodialysis, it was stated that individuals experienced mostly headache and daytime fatigue associated with hypotension. They wanted to terminate treatment before the period of dialysis if their hypotension-related problems were not resolved despite the medical interventions. They felt adverse effects from the hypotension both during dialysis and for the rest of the day, they slept for at least four hours at home to recuperate, and they described the day after HD as a "dead day".[12] In another study, it was determined that more than 50% of the patients undergoing HD slept for an average of 4.8 hours and rested at home in order to cope with the headache and fatigue associated with dialysis-induced hypotension.[13]

In HD patients, fatigue depended on factors such as accumulation of wastes (urea, uric acid, and creatine) in the body, blood pressure patterns, excessive UVF, long-term positioning in the dialysis plane, fluid-electrolyte balance, hematopoietic anemia, failure to fulfil metabolic and endocrine functions, and psychological reasons.

The symptoms experienced by the patients during dialysis hypotension and their fatigue associated with these symptoms negatively affect their adherence to therapy and impaired their quality of life.[13,14] The main objective of nursing care is to positively affect the physical, social, and psychological aspects of patients' quality of life. Numerous complementary-supportive practices can be performed in order to enhance quality of life and adherence to therapy among patients undergoing hemodialysis and to minimize the adverse effects of disease and treatment. There are studies indicating that acupressure, one of these practices, provides regulation of blood pressure and pulse rate in patients receiving HD treatment,[15] positively affects biochemical variables,[15,16] reduces the pain[17] and fatigue level,[18-20] relieves uremic pruritus,[21] and enhances the sleep quality and quality of life.[16-18]

Physiological studies have revealed that acupuncture points on deep and superficial somatic nerves are effective. It is determined that especially stimulation of the Neiguan (P6) point with acupressure activates the arcuate nucleus and stimulates neurons containing opioids, glutamates or both in the arcuate nucleus.[13-16] In this way, it provides blood pressure regulation through stimulation of autonomic nervous system and the regulation of stimulated cardiovascular reflexes.[13-16]

Despite the restrictions imposed by chronic diseases and treatment methods, the most important responsibilities of nurses are to reduce the complications and side effects induced by HD, relieve symptoms, ensure patients feel well as much as possible, understand what they experience, assist them in their daily living, and to enhance their quality of life.[14, 22-26]

In the literature, no study indicating the effect of body acupressure performed by electrostimulation devices on blood pressure during HD in Turkey has been found. If the efficiency of this application can be determined, it may be possible to reduce drug intake and prevent many symptoms, such as headaches and fatigue associated with hypotension in HD patients who use too many vasoconstrictor drugs. It is also thought that undergoing more efficient because there would be no need for interventions that reduce the effect and adequacy of dialysis in order to treat hypotension.

Since hypotension is one of the most common complications experienced during HD and there are studies indicating that stimulation of the P6 (Neiguan) acupuncture point affects blood pressure, this study examines the effect of acupressure performed on this point on blood pressure regulation as well as its effect on symptoms such as hypotension-associated fatigue and pain.[15-19]

This randomized controlled trial had three research questions.

The first question asks if 12-session body acupressure, which is performed using an electrostimulation device, has any impact on blood pressure in individuals suffering from hypotension during hemodialysis.

The second question questions the effect of 12-session body acupressure, which is performed using an electrostimulation device, on headaches in individuals suffering from hypotension during hemodialysis.

The third question explores whether there any effect when 12 sessions of body acupressure, which is performed by using electrostimulation device on blood pressure and fatigue levels in individuals suffering from hypotension during hemodialysis.

GOAL

This randomized controlled experimental trial was designed to determine the effect of 12-session body acupressure, which was performed using an electrostimulation device on the Neiguan (P6) acupuncture point for one hour at the third hour of dialysis, on blood pressure, headaches, and fatigue levels in individuals who experienced hypotension during haemodialysis.

METHODS

Design

The population of the study consisted of 394 patients undergoing HD treatment at three hemodialysis centers in two city centers in Turkey.

The study was completed with a total of 135 patients who met the inclusion criteria of the study between June 1, 2013 and September 1, 2013 (67 patients in the intervention group and 68 patients in the placebo group). The study were assessed using the SigmaStat 3.5 program and the power was found to be 0.891 for the Piper fatigue scale, 1.000 for VAS fatigue and 1.000 VAS pain in the intervention and placebo groups with an error margin of 0.05.

Randomization

In the study, the sample selection was performed in accordance with randomisation protocol. The method of drawing lots was used to determine whether or not the patients meeting inclusion criteria of the study in the morning and afternoon session groups would be assigned to the intervention or placebo groups and from which group the

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Figure 1. Attachment of the Electrostimulation Device to the Neiguan Acupuncture Point

order of assignment would be started. As a result of drawing, individuals undergoing HD in the morning were included in the intervention group and those undergoing HD in the afternoon were included in the placebo group. A total of 150 patients, meeting the inclusion criteria, were reached during the study. Five patients in the intervention group did not agree to participate in the study. Two of these patients experienced local pruritus in the area the device was applied, one patient developed a fistula problem, and two patients left the city during the follow-up. Additionally, three patients in the placebo group did not want to continue the study since two of these patients were receiving treatment in a hospital out of the city due to coronary angiography. Therefore, the study was completed with 135 patients (Figure 1). The procedure-related side effects did not develop in all the patients included in the study and no patients felt unwell during or after the procedure.

Inclusion Criteria

Individuals who were older than 18 years, participated in HD program for an average of 4 hours, three times a week for at least 6 months, experienced hypotension during HD, could keep their fluid intake and diets constant during the study, were capable of answering all of the questions, gained 2500 grams or more between dialysis sessions, and agreed to participate in the study, were included in the study.[15-21]

Exclusion Criteria

Individuals who did not experience hypotension problems during hemodialysis, had cardiac pacemakers, were pregnant, had fistulas in both arms, experienced psychiatric problems, or who suffered from nerve, soft tissue or vascular disease in their upper extremities were not included in the study because they were thought to affect the results of the study.[15-21]

The study was terminated for the patients who experienced problem during the procedure, whose hemodialysis program changed, did not want to continue acupressure at any stage of the study, decided to continue their treatment elswhere, or who were undergoing treatment at the hospital due to any reason other than for hemodialysis treatment.[16-19]

Instruments

The data of the study were collected by using a questionnaire, VAS for pain (measurement of pain level), VAS for fatigue, and the Piper fatigue scale. An electrostimulation device was also used in the study to perform acupressure on the patients.

Questionnaire

The questionnaire, developed by the researchers in accordance with the literature,[1-9] consisted of five parts, including "socio-demographic characteristics," "information related to the disease and treatment," "hypotension-induced symptoms observed in patients during HD," "laboratory findings," and "measurements result of blood pressure and pulse rate."

Measurement of Pain and Fatigue Level- Visual Analogue Scale (VAS)

In the study, pain and fatigue were assessed by VAS on which numbers 0 - 10 were placed with equal intervals on a 10 cm horizontal line. The patients were asked to mark the number that reflected their pain and fatigue. The presence of the worst pain and fatigue was rated a 10, while minimal pain and fatigue was indicaed by lower numbers.[30]

Piper Fatigue Scale

The scale, which was developed by Piper et al., in 1998, includes a total of 27 items and evaluates subjective perception of the patients on fatigue under four subscales. These subscales are behavioural/severity subscales assessing the effect and severity of fatigue on activity of daily living (ADL); an affective subscale that include emotional meaning attributed to fatigue; a sensory subscale reflecting psychological, physical, and emotional symptoms of fatigue; and a cognitive/mood subscale reflecting the level of fatigue required to affect cognitive functions and mood.[31]

Scoring the Scale: Subscale scores were obtained by totaling the points of all items in that subscale and dividing the sum by the number of items. Responses for each item were scored between 0-10 points. The total fatigue score was obtained by summing the points of 22 items, then dividing the sum into the number of items. High scores signify a high level of perceived fatigue.

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The validity and reliability study of the scale for Turkish society was conducted by Can and Cronbach's alpha coefficient was found as 0.94.[32] In this study, Cronbach's alpha coefficient of the scale was calculated at 0.729 before the intervention and 0.779 after the intervention.

Electrostimulation Device

The device was used to perform acupressure to the Neiguan (P6) acupuncture point on the wrist (the region between the flexor carpi radialis and palmaris longus tendons on the line of the middle finger at a distance of two finger widths from the inner curve of the wrist) through electrostimulation (Figure 1). The device is battery-powered.[34] Since the Neiguan (P6) acupuncture point has an effect on cardiovascular system and thus regulates blood pressure, this point was used in this study.

Procedure

The researcher participated in an "Acupressure and Aromatherapy Course," including a 24-hour theoretical and applied training in this skill.

Procedures Applied to Intervention and Placebo Groups

The patient data relating to the questionnaire, VAS pain (measurement of pain level), VAS fatigue, and Piper fatigue scale at the first follow-up (the first interview before acupressure) were collected by the researcher. Body acupressure was applied on the Neiguan (P6) acupuncture point via electrostimulation. The electrostimulation device was attached to the Neiguan (P6) acupuncture point of each patient in the intervention group for an hour at the third hour of each dialysis session three times a week for a month in accordance with the administration protocol prepared by the researcher. The questionnaires were administered at the beginning of the application (first follow-up) and four weeks later (second follow-up). In the intervention group, the electrostimulation device was attached to the Neiguan (p6) acupuncture point and operated at the third hour of each dialysis session, three times a week for one month. On the other hand, in the placebo group, the device was attached to the same acupuncture point but its batteries were removed and it was not operated.

After four weeks (at the second follow-up of the patients, a month later), the VAS pain, VAS fatigue, and Piper fatigue scale were applied to the patients again and results of these scales and laboratory findings as well as body mass index (BMI), weight difference between predialysis and postdialysis periods, targeted ultrafiltration rate (UR), actual UR, systolic blood pressure (SBP), diastolic blood pressure (DBP) and pulse rates in the questionnaire were recorded. The patients in the intervention group were informed about the administration of VAS pain and VAS fatigue and were asked to mark these scales. Both scales were assessed not only at the first and second follow-ups but also at the end of each HD session and weekly averages of these values were calculated. The blood pressure and pulse rates of the patients were monitored hourly during the HD session and they were measured again after HD procedure. Since hemodialysis-associated fatigue continued both during the treatment and for the rest of the day, the fatigue levels of the patients were also evaluated at home. VAS fatigue was delivered to the patients at the end of each HD session. They were told that nurses would call them to mark VAS fatigue four hours after they arrived home. During this call, the patients were asked to mark VAS fatigue as previously informed. They were also asked to bring along the scale when they came for the following HD session.

Data analysis

The data were evaluated by using Statistical Package for the Social Sciences Statistics (IBM SPSS) 21.0 and SigmaStat 3.5 statistical software. Summary statistics were given as the number of units (n), percentage (%), and mean ± standard deviation. The distribution of the numerical variables was evaluated using the Shapiro-Wilk normality test. Homogeneity of variances was tested using Levene's test. While independent samples *t* test was used for comparisons of two groups, one-way analysis of variance was used for comparisons of more than two groups. While the paired t test was used to evaluate two consecutive measurements, one-way repeated analysis of variance was used to evaluate more than two measurements. While Student-Newman-Keuls test was used for multiple comparisons, Pearson correlation analysis for comparison of numerical variables and the exact method of Chi-square analysis for comparison of categorical variables were used. McNemar and McNemar Bowker tests were used for consecutive evaluations of categorical variables. The value of $P < .05$ was accepted as statistically significant.

RESULTS

The Socio-Demographic and Individual Characteristics of the Patients

It was found that 64.2% of the patients in the intervention group were female, 44.8% were in the 65 years and over age group, 50.7% were primary school graduates, 86.6% were married, 53.7% had a nuclear family, 91.1% were unemployed, 70.1% had a middle income level according to their own statements, and 56.7% were residing in urban areas. Within the placebo group, 55.9% of the patients were female, 58.8% were in the 65 years and over age group, 44.1% were illiterate, 88.2% were married, 51.5% had a nuclear family, 92.7% were unemployed, 80.9% had a middle income level according to their own statements, and 61.8% were residing in urban areas (Table 1). The patients in the intervention and placebo groups were similar in terms of the other descriptive characteristics except for age, income, and educational level ($P > .05$).

Results Concerning Distribution of Disease-Related Characteristics of the Patients

The patients in the intervention group were receiving HD for 70.85 ± 54.20 months while they were patients with

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chronic renal failure (CRF) for an average of 79.83 ± 56.88 months. It was found that 85.1% of the patients had arteriovenous fistula in their vascular access routes, 46.3% of the patients had normal BMIs, and transplantation was not planned for 61.2% for patients. Dietary adherance was positive for 71.6% of the patients, 92.5% were complying their medication, and 97.0% were taking phosphorus-binding agents. It was determined that 85.1% had chronic disease other than CRF and 56.1% were patients with DM.

The patients in the placebo group were undergoing HD for 71.21 ± 46.93 months while they had CRF for 77.41 ± 42.12 months, on average. It was determined that 83.8% of the patients had arteriovenous fistula in their vascular access routes, BMI was normal in 48.5% of patients, and transplantation was not planned for 58.8%. Compliance with dietary advice was evident in 69.1% of patients, 92.6% adhered to their medication regime, and 94.1% were taking phosphorus-binding agents. Some 70.6% of patients had another chronic disease and 50.0% were DM patients excepting for CRF.

Results Concerning the Distribution of Characteristics of Hypotension Experienced by the Patients During Hemodialysis

It was determined that 70.1% of the patients in the intervention group and 80.9% of the patients in the placebo group experienced hypotension mostly in the third hour of HD ($P > .05$). All of the patients in the intervention group and 94.1% of the patients in the placebo group were given Trendelenburg position in nursing interventions for hypotension (Table 2).

Comparison of Systolic and Diastolic Blood Pressures and Pulse Rates of the Patients in Terms of Their Time of Hemodialysis

As the frequency of acupressure increased in patients in the intervention group, their mean SBP increased from the second week compared to the placebo group.This increase was significantly higher at the second, third, and fourth hours of the third and fourth weeks and at the end of HD (Table 3), ($P < .05$).

Mean DBP of the patients in the intervention group was significantly higher at the fourth hour compared to the third hour of acupressure and at the end of HD for all weeks compared to the placebo group (Table 4), ($P < .05$). Mean pulse rates during the follow-up were lower in patients in the intervention

Table 1. The Distribution of the Descriptive Characteristics of the Patients in the Intervention and Placebo Groups

Descriptive Characteristics	GROUPS				Total (n = 135)	
	Intervention (n = 67)		Placebo (n = 68)			
	n	%	n	%	n	%
Gender						
Female	43	64.2	38	55.9	81	60.0
Male	24	35.8	30	44.1	54	40.0
P Value	.381					
Age Groups						
25-34 years	0	0.0	2	2.9	2	1.5
35-44 years	5	7.5	0	0.0	5	3.6
45-54 years	7	10.4	10	14.8	17	12.6
55-64 years	25	37.3	16	23.5	41	30.4
65 years and above	30	44.8	40	58.8	70	51.9
P Value	.018					
Average Age ($\bar{x} \pm ss$)	64.0 ± 11.6		65.8 ± 12.1		64.9 ± 11.8	
P Value	.037					
Educational Level						
Illiterate	29	43.3	30	44.1	59	43.7
Literate	2	3.0	8	11.8	10	7.4
Primary School	34	50.7	21	30.9	55	40.7
High School	2	3.0	9	13.2	11	8.1
P Value	.009					
Marital Status						
Single	9	13.4	8	11.8	17	12.6
Married	58	86.6	60	88.2	118	87.4
P Value	.801					
Family Type						
Nuclear Family	36	53.7	35	51.5	71	52.6
Extended Family	31	46.3	31	45.6	62	45.9
Temporary Family	0	0.0	2	2.9	2	1.5
P Value	.580					
Working Status						
Employed	6	8.9	5	7.3	11	8.1
Unemployed	61	91.1	63	92.7	124	91.9
P Value	.490					
Income Status						
Very High	1	1.5	0	0.0	1	0.7
High	12	17.9	3	4.4	15	11.1
Middle	47	70.1	55	80.9	102	75.6
Low	5	7.5	10	14.7	15	11.1
Very Low	2	3.0	0	0.0	2	1.4
P Value	.012					
Residence Place						
Urban Region	38	56.7	42	61.8	80	59.3
Rural Region	29	43.3	26	38.2	55	40.7
P Value	.601					

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Table 2. The Distribution of Hypotension Characteristics Experienced by the Patients in the Intervention and Placebo Groups During Hemodialysis

	GROUPS						
	Intervention (n = 67)		Placebo (n = 68)		Total (n = 135)		
Hypotention Characteristics	**n**	**%**	**n**	**%**	**n**	**%**	***P value***
The Most Intense Hypotension Experience							
The First Hour	1	1.5	2	2.9	3	2.2	.390
The Second Hour	3	4.5	1	1.5	4	3.0	
The Third Hour	47	70.1	55	80.9	102	75.6	
End of Hemodialysis	16	23.9	10	14.7	26	19.2	
Nursing Interventions[a]							
UR Reduction	52	77.6	55	80.9	107	79.3	.676
Reduced Pump Speed	54	80.6	52	76.5	106	78.5	.676
Intravenous Fluid Administration	65	97.0	65	95.6	130	96.3	1.000
Medication	9	13.4	15	22.1	24	17.8	.261
Position	67	100	64	94.1	131	97.0	.119
Termination of Dialysis	21	31.3	20	29.4	41	30.4	.853

[a]multiple answers were given, and percentages were calculated over n.

Table 3. The Comparison of Systolic Blood Pressures of the Individuals in the Intervention and Placebo Groups in Terms of Hemodialysis Time

	Frequency of Application, Weeks, Systolic Blood Pressure (mmHg)							
	The First Week		The Second Week		The Third Week		The Fourth Week	
Times During the Hemodialysis Sessions	**Intervention Group (n = 67)**	**Placebo Group (n = 68)**	**Intervention Group (n = 67)**	**Placebo Group (n = 68)**	**Intervention Group (n = 67)**	**Placebo Group (n = 68)**	**Intervention Group (n = 67)**	**Placebo Group (n = 68)**
	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$
The First Hour	118.21 ± 11.37[a]	114.91 ± 13.56[a]	118.13 ± 11.28[a]	114.27 ± 13.16[a]	116.16 ± 13.13[a]	113.22 ± 12.98[a]	117.85 ± 10.63[a]	113.76 ± 13.31[a]
P value	.127		.070		.193		.051	
The Second Hour	109.58 ± 10.85[b]	107.19 ± 11.76[b]	108.39 ± 10.47[b]	104.39 ± 10.02[b]	108.11 ± 10.80[b]	103.92 ± 10.73[b]	110.77 ± 11.84[b]	105.84 ± 10.14[b]
P value	.221		.025		.025		.010	
The Third Hour	102.78 ± 9.91[c]	99.92 ± 7.88[c]	102.36 ± 8.88[c]	100.12 ± 8.24[c]	103.65 ± 9.25[c,d]	99.46±8.59[c,d]	103.75 ± 9.36[c]	99.14 ± 8.49[c]
P value	.067		.130		.007		.003	
The Fourth Hour	100.96±6.90[c]	95.41±7.23[d]	93.56±5.49[c]	93.31±5.12[d]	103.93±8.26[b,d]	95.17±6.66[c]	104.79±7.24[c]	94.82 ± 7.39[d]
P value	<.001		.790		<.001		<.001	
End of Hemodialysis	108.98 ± 9.02[b]	103.71 ± 6.67[e]	109.27 ± 8.47[b]	102.58 ± 7.74[b]	109.37 ± 7.84[b]	102.85 ± 7.23[d]	108.07 ± 9.15[d]	103.60 ± 8.54[e]
P value	<.001		<.001		<.001		.004	
P value	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Note: The upper, a, b, c, d, and e symbols show the difference in each group and the same letters indicate the lack of difference. One-way repeated analysis of variance, McNemar, McNemar Bowker, Student-Newman-Keuls, and independent sample *t* tests were performed Systolic blood pressure values (mean ± standard deviation) at the first, second, and third hemodialysis sessions by weeks were given

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Table 4. Comparison of Diastolic Blood Pressures of the Individuals in the Intervention and Placebo Groups in Terms of Hemodialysis Time

Times During Hemodialysis Sessions	Frequency of Application, Weeks, Diastolic Blood Pressure (mmHg)							
	The First Week		The Second Week		The Third Week		The Fourth Week	
	Intervention Group	Placebo Group	Intervention Group	Placebo Group	Intervention Group	Placebo Group	Intervention Group	Placebo Group
	(n = 67)	(n = 68)	(n = 67)	(n = 68)	(n = 67)	(n = 68)	(n = 67)	(n = 68)
	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$	$\bar{x} \pm ss$
The First Hour	73.65 ± 6.57[a]	70.82 ± 7.78[a]	73.39 ± 7.57[a]	69.67 ± 7.32[a]	73.19 ± 7.33[a]	71.68 ± 6.59[a]	73.60 ± 6.58[a]	71.36 ± 7.59[a]
P value	.024		.004		.211		.069	
The Second Hour	67.77 ± 7.61[b]	66.59 ± 6.39[b]	67.85 ± 7.78[b]	66.96 ± 5.15[b]	67.77 ± 6.89[b]	66.50 ± 5.97[b]	69.27 ± 7.31[b]	67.09 ± 5.63[b]
P value	.330		.436		.253		.054	
The Third Hour	63.57 ± 5.78[c]	62.88 ± 5.67[c]	63.56 ± 5.49[c]	63.31 ± 5.12[c]	78.41 ± 6.40[c]	79.41 ± 5.29[c]	64.95 ± 7.14[c]	62.91 ± 4.69[c]
P value	.483		.988		1.952		.053	
The Fourth Hour	64.95 ± 5.80[c]	59.56 ± 5.46[d]	60.34 ± 4.89[b]	66.41 ± 6.19[d]	66.41 ± 6.19[b,c]	59.69 ± 5.03[d]	66.72 ± 5.47[c]	60.30 ± 6.20[d]
P value	<.001		<.001		<.001		<.001	
End of Hemodialysis	69.90 ± 5.49[d]	65.46 ± 5.47[b]	70.55 ± 6.02[d]	66.40 ± 5.75[b]	69.93 ± 6.94[d]	66.18 ± 5.60[b]	69.68 ± 7.27[b]	66.89 ± 5.76[b]
P value	<.001		<.001		.001		.015	
P value	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Note: One-way repeated analysis of variance, McNemar, McNemar Bowker, Student-Newman-Keuls, and independent samples *t* tests were performed. Diastolic blood pressure values (mean ± standard deviation) at the first, second, and third hemodialysis sessions by weeks were given. The upper, a, b, c, and d symbols show the difference in each group and the same letters indicate the lack of difference

group than those in the placebo group although it was not statistically significant ($P > .05$).

Results Concerning the Distribution of the Patients' Fatigue-Related Characteristics and VAS Fatigue Mean Scores

It was found that 43.3% of the patients in the intervention group and 35.5% of the patients in the placebo group stated that their cause of fatigue was HD. While mean fatigue time of intervention group was 48.67 ± 34.84 months, mean fatigue time of placebo group was 59.69 ± 37.96 months. While 26.9% of the patients in the intervention group described fatigue as "weakness," 49.3% stated that they slept in order to reduce fatigue. Fatigue was of sufficient severity in 23.5% of the patients in the placebo group to be described as "prostration" and 50.0% expressed that they slept in order to reduce fatigue ($P > .05$), (Table 5).

The VAS fatigue mean scores of those in the intervention group were significantly lower at the first and third sessions in the first week ($P < .05$), (Table 5). The VAS fatigue mean scores at the second and third sessions and at home in the second week were lower in the intervention group than placebo group ($P < .05$). The VAS fatigue mean scores at the first, second, and third sessions and at home in the third and fourth weeks were significantly lower in the intervention group than placebo group ($P < .01$). As the frequency of acupressure increased in individuals in the intervention group during follow-up, the VAS fatigue mean scores decreased by weeks.

Results Concerning the Distribution of Patient VAS Pain Mean Scores

It was determined that while VAS pain mean scores of those in the intervention group were significantly higher at the beginning of acupressure compared to placebo group, they were significantly lower at the end of acupressure ($P < .001$), (Table 6). While VAS pain mean scores decreased in both groups during the application, the decrease in pain level was greater in the intervention group.

Results Concerning the Patients' Piper Fatigue Scale Mean Scores at the First and Second Follow-Ups

The Piper fatigue scale mean scores for the patients in the intervention group at the first follow-up were 7.19 ± 1.13 in the behavioural/severity subscale, 6.87 ± 1.47 in the affective subscale, 6.56 ± 1.82 in the sensory subscale, 4.44 ± 1.82 on the cognitive/mood subscale, and 6.23 ± 0.93 in total. The mean scores calculated for the patients in the placebo group for the Piper fatigue Scale at first follow-up were 6.80 ± 1.31 on the behavioural/severity subscale, 6.78 ± 1.41 on the affective subscale, 6.36 ± 1.65 on the sensory subscale, 4.26 ± 1.85 for the cognitive/mood subscale, and 5.89 ± 1.07 in total. It was found that all subscale and total mean scores for the Piper fatigue scale at the first follow-up were higher in the intervention group than in the placebo group but the differences between them was not statistically significant ($P > .05$), (Table 7).

The mean scores obtained by the patients in the intervention group for the Piper fatigue scale at the second follow-up were 6.67 ± 1.11 on the behavioural/severity subscale, 6.36 ± 1.48 on the affective subscale, 5.64 ± 2.21 for

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Table 5. Distribution of the VAS Fatigue Mean Scores of Individuals in the Intervention and Placebo Groups

Frequency of Application / Weeks	VAS Fatigue: Intervention Group (n=67) $\bar{x} \pm ss$	VAS Fatigue: Placebo Group (n=68) $\bar{x} \pm ss$	*P* value
The First Week			
The First Session	7.27 ± 1.46[a]	6.42 ± 2.09[a]	.007
The Second Session	6.21 ± 1.54[b]	6.48 ± 2.25[a]	.423
The Third Session	5.07 ± 1.54[c]	6.02 ± 2.10[a]	.004
Follow-Up at Home	6.87 ± 1.44[d]	7.00 ± 1.90[b]	.668
P value	<.001	<.001	
The Second Week			
The First Session	6.02 ± 1.49[a]	6.53 ± 2.00	.096
The Second Session	5.20 ± 1.27[b]	6.41 ± 1.88	<.001
The Third Session	4.44 ± 1.15[c]	6.39 ± 1.96	<.001
Follow-Up at Home	5.91 ± 1.29[a]	6.75 ± 2.11	<.001
P value	<.001	<.346	
The Third Week			
The First Session	5.34 ± 1.46[a]	6.30 ± 1.92[a]	.001
The Second Session	4.86 ± 1.37[b]	6.24 ± 1.86[a]	<.001
The Third Session	4.27 ± 1.25[c]	6.09 ± 1.95[a]	<.001
Follow-Up at Home	4.99 ± 1.40[b]	6.76 ± 2.05[b]	<.001
P value	<.001	.002	
The Fourth Week			
The First Session	4.74 ± 1.24[a]	6.53 ± 1.81[a]	<.001
The Second Session	3.99 ± 1.29[b]	6.38 ± 1.83[a]	<.001
The Third Session	3.42 ± 1.36[c]	5.94 ± 2.03[b]	<.001
Follow-Up at Home	4.24 ± 1.16[b]	6.73 ± 1.97[a]	<.001
P value	<.001	<.001	

Note: One-way repeated analysis of variance, McNemar, McNemar Bowker, Student-Newman-Keuls, and independent sample *t* tests were performe. The upper, a, b, c, and d symbols show the difference in each group and the same letters indicate the lack of difference.

Table 6. The Distribution of the VAS Pain Mean Scores in Individuals in the Intervention and Placebo Groups

Frequency of Application / Weeks	VAS Pain Intervention Group (n = 67) $\bar{x} \pm ss$	VAS Pain Placebo Group (n = 68) $\bar{x} \pm ss$	*P* value
The First Week			
The First Session	6.57 ± 1.55[a]	4.83 ± 2.16	<.001
The Second Session	5.81 ± 1.41[b]	5.30 ± 2.15	.103
The Third Session	4.60 ± 1.75[c]	5.47 ± 2.01	.009
P value	<.001	.108	
The Second Week			
The First Session	6.26 ± 1.31[a]	5.50 ± 2.12	.014
The Second Session	5.58 ± 1.29[b]	5.74 ± 2.14	.595
The Third Session	4.81 ± 1.24[c]	5.54 ± 1.99	.012
P value	<.001	.327	
The Third Week			
The First Session	5.61 ± 1.42[a]	5.22 ± 1.96	.189
The Second Session	4.91 ± 1.27[b]	5.03 ± 1.74	.659
The Third Session	4.23 ± 1.26[c]	5.31 ± 1.74	<.001
P value	<.001	.363	
The Fourth Week			
The First Session	4.82 ± 1.66[a]	5.12 ± 2.14[a]	.369
The Second Session	4.14 ± 1.52[b]	4.90 ± 2.13[a,b]	.018
The Third Session	3.62 ± 1.61[c]	4.68 ± 1.93[b]	.001
P value	<.001	.005	

Note: One-way repeated analysis of variance, McNemar, McNemar Bowker, Student-Newman-Keuls, and independent sample *t* tests were performed. The upper, a, b, and c symbols show the differences in each group and the same letters indicate the lack of difference

Table 7. The Distribution of the Piper Fatigue Scale Mean Scores for the Intervention and Placebo Groups at the First and Second Follow-ups

Piper Fatigue Scale	Intervention Group (n = 67): The First Follow-Up $\bar{x} \pm ss$	Intervention Group (n = 67): The Second Follow-Up $\bar{x} \pm ss$	*P* value	Placebo Group (n = 68): The First Follow-Up $\bar{x} \pm ss$	Placebo Group (n = 68): The Second Follow-Up $\bar{x} \pm ss$	*P* value
Behavioural/Severity Subscale	7.19 ± 1.13	6.67 ± 1.11	.072	6.80 ± 1.31	6.88 ± 1.25	.296
P value	<.001			.359		
Affective Subscale	6.87 ± 1.47	6.36 ± 1.48	.715	6.78 ± 1.41	7.22 ± 1.36	.001
P value	<0.001			<0.001		
Sensory Subscale	6.56 ± 1.82	5.64 ± 2.21	.512	6.36 ± 1.65	6.73 ± 1.81	.002
P value	<0.001			0.002		
Cognitive/Mood Subscale	4.44 ± 1.82	3.96 ± 1.93	.557	4.26 ± 1.85	4.38 ± 1.66	.175
P value	<0.001			0.126		
Total Fatigue Score	6.23 ± 0.93	5.84 ± 1.47	.055	5.89 ± 1.07	6.18 ± 1.12	.137
P value	.002			<.001		

Note: McNemar, McNemar Bowker, Student-Newman-Keuls, and Paired *t* Tests were performed

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the sensory subscale, 3.96 ± 1.93 for the cognitive/mood subscale, and 5.84 ± 1.47 in total. All subscale and total mean Piper fatigue scale scores decreased significantly in the intervention group at the second follow-up compared to the first follow-up ($P < .05$). The mean scores of the patients in the placebo group for Piper fatigue scale at the second follow-up were found as 6.88 ± 1.25 on the behavioural/severity subscale, 7.22 ± 1.36 on the affective subscale, 6.73 ± 1.81 on the sensory subscale, 4.38 ± 1.66 in cognitive/mood subscale, and 6.18 ± 1.12 in total.

Affective subscale, sensory subscale, and total mean scores for the Piper fatigue scale were significantly higher in the placebo group at the second follow-up compared to the first follow-up ($P < .05$). It was determined that all subscale and total Piper fatigue scale mean scores were lower at the second follow-up in the intervention group than in the placebo group and the decreases in the affective and sensory subscales were statistically significant ($P < .05$), (Table 7).

DISCUSSİON

The results of a limited number of studies in the literature evaluating the effect of acupressure on blood pressure levels in patients undergoing HD are similar to results of the present study.[15] In the present study, it was found that mean systolic and diastolic blood pressures were higher in the intervention group than in the placebo group for four weeks and the differences between them were significant ($P < .05$). In the study to examine the effect of acupressure, conducted by Farese et al.[15] on 10 patients undergoing HD, performed using Compex2- transcutaneous electrical muscle stimulations on blood pressure, urea, and phosphate excretion, the authors determined that predialysis-postdialysis SBP and DBP values and pulse rates in the intervention group increased significantly. Unlike the result of the study by Farese et al.,[15] it was determined in the present study that acupressure decreased pulse rate. In a study examining the effect of acupressure, performed on the Neiguan (PC6), Shenmen (HT7), and Danzhong (CV17) points, on pulse rate and rhythm control in individuals with atrial fibrillation (AF), it was also found that the heart rate of the acupressure group decreased after each application and there was a difference between pulse rates in the acupressure and placebo groups, which was similar to the results of the present study.[34] In the present study, it was found that acupressure significantly decreased physical problems depending on hypotension impairing the quality of life of individuals undergoing HD.

Fatigue is a very common problem experienced by patients undergoing HD and many factors are effective in developing this problem. Some of these factors include accumulation of waste products in the body, changes in blood pressure, lack of movement during HD treatment, psychological reasons, and anemia.[35-50] When individuals were asked about the cause of their fatigue in the present study, most patients in both groups stated HD treatment as the cause. In the studies by Eğlence et al.[20] and Özdemir,[51] similar results were obtained. In the studies on fatigue, it was determined that patients undergoing HD experienced fatigue at the rate of 75-92.5% and fatigue was a factor considerably affecting daily living activities and life quality of individuals.[48,52, 53] In order to prevent fatigue symptom from affecting negatively individuals, it is vital to evaluate fatigue, plan proper related interventions and apply effective coping methods.[14,24,54]

Numerous studies have revealed that integrative methods administered to HD patients by nurses have an important place in fatigue management.[18, 20,51,55] In the study by Eğlence et al.,[20] a 12-session acupressure treatment was performed at the GB34, ST36, SP6, and K1 acupuncture points of HD patients for 25 minutes during the first half of each dialysis session. It was determined that while there were no statistical differences between the VAS fatigue score medians of the patients in the intervention and placebo groups at the first follow up ($P > .05$), the median VAS fatigue scores decreased in the intervention group at the second follow up compared to the first follow up and increased in the control group at the second follow up compared to the first follow up ($P < .05$). Additionally, in the same study, the median scores for individuals in the intervention group from the other subscales of the Piper fatigue scale, except for the cognitive/mood subscale and total median fatigue scores decreased at the second follow up compared to the first follow up ($P < .05$). In the study conducted by Tsay, Cho and Chen to determine the effect of acupressure performed by transcutaneous electrical stimulation on the fatigue levels of patients undergoing HD, acupressure was found to decrease individuals' fatigue perception.[18] It was determined in another study by Tsay that acupressure decreased fatigue perception in patients undergoing HD.[19]

In parallel to the results of previous studies, it was found in the present study that, while there were no statistical differences between the placebo and intervention groups at the first follow up in terms of fatigue subscale and total mean scores ($P > .05$), fatigue subscale and total mean scores decreased in the intervention group at the second follow up compared to the first follow up. On the other hand, the fatigue subscale and total mean scores of individuals in the placebo group increased and the differences between the groups were statistically significant ($P < .05$). Stimulation of acupuncture points has been shown to increase the production of serotonin and endorphin and to positively modulate the regulation of serum cortisol. Indeed, pressure stimulation of the acupoints causes complex neuro-hormonal responses, one of these possibly involving the hypothalamic-pituitary-adrenocortical axis to counteract the overproduction of cortisol.[44-46] In this context, the release of neuromodulators after acupressure might improve the disrupted cortical plasticity and reduced fatigue.[46]

It was reported in some studies that most patients experienced the most intense fatigue and absolutely needed to resting 2-3 hours after dialysis sessions due to ultrafiltration, diffusion, osmotic imbalance, blood pressure changes, blood

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membrane interactions, and psychological factors such as depression.[12,51,56,57] The present study revealed results similar to those obtained in these studies. In the present study, individuals in both groups stated that they slept, took a rest, and obeyed the diet in order to reduce fatigue after HD.

Because hemodialysis-induced fatigue continues not only during treatment but throughout the rest of the day, it may negatively influence individuals' daily activities, relationships with family and friends, professional lives, sexual lives, and the treatment process.[50,54] Because this situation would create many negataive effects on individuals in terms of physical, psychological and socio-economic aspects, fatigue management is extremely important for patients undergoing HD. It was noted in the present study that when individuals were asked about their fatigue level at home four hours after HD session during the acupressure process, the VAS fatigue mean scores were lower in the intervention group compared to placebo group and as the time of application increased, the severity of perceived fatigue decreased ($P < .001$).

Pain is also an important problem for HD patients because of increasing evidence indicating that patients undergoing hemodialysis often experience both acute and chronic pain such as headaches, musculoskeletal system pain, and back pain as a result of their treatment.[43,46,58] Since pain might be associated with low quality of life, it should be controlled effectively. However, prevalence, aetiology, intensity, and treatment of pain have not been identified sufficiently in patients undergoing dialysis.[58,59] Today, drugs are commonly used in pain control and analgesic therapy is the preferred treatment method of pain relief because it shows rapid action and is easy to apply.[61-63] Non-pharmacological methods are also used in pain control. Because integrative methods have an effect decreasing the pain intensity, their use has become widespread, especially in recent years.[63-65] The studies conducted on patients undergoing HD revealed that integrative methods such as aromatherapy massage, reflexology, and relaxing music were effective in relieving pain or reducing its intensity.[51,67,68]

There has been no study in the literature examining the effect of acupressure on individuals experiencing pain during HD. In the present study conducted based on this point of view, it was found that acupressure decreased the level of headache experienced by patients in both intervention and placebo groups and the decrease in VAS pain mean scores was greater in the intervention group ($P < .05$). The decrease in pain level was greater in individuals in the intervention group since acupressure activates the gate control mechanism and the impulses of sensory A-fibres in the skin cover the pathway to the brain and close the gate for pain transition. Additionally, sensory A-fibres increase beta endorphin levels by activating the release of natural opioids in body. Increased release of beta endorphins is thought to affect pain perception by increasing pain threshold and decreasing or eliminating the feelings of pain.[69-71] The fact that VAS pain mean scores decreased in the placebo group is thought to be associated with decreasing blood urea levels due to HD and elimination of the toxic effects of uremia in the brain. Electrolyte imbalances caused by excessive fluid volume returned to normal, depending on UR during dialysis, which could have affected this result.

Although acetylsalicylic acid (ASA), nonsteroidal anti-inflammatory drugs (NSAID), acetaminophen, codeine, dihydrocodeinone, and tramadol derivatives preferred as first options are effective in pain management of patients undergoing hemodialysis, the risk of drug accumulation, which could occur depending on the induction of analgesic drugs due to decreased renal clearance, may increase in patients.[59,65] The use of integrative methods, like acupressure, by nurses in management of pain occurring during the HD process has become important in risk management during the treatment process.

CONCLUSION

This study has revealed that body acupressure applied at the Neiguan (P6) acupuncture point via electrostimulation for one hour at the third hour of dialysis three times a week for a month (4 weeks) normalised the SBP and DBP of individuals developing HD hypotension in repetitive applications, reduced pulse rate, decreased fatigue subscale and total score and also level of fatigue experienced at home, reduced mean score, and intensity of pain; and relieved the symptoms developing due to hypotension during HD. To support these results, conducting randomized, single- or double-blind studies involving longer-term acupressure to other acupuncture points that are effective on the circulatory system is recommended.

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ETHICAL CONSIDERATIONS

Ethical approval was granted by the Clinical Trials Ethics Committee of the University (2012/459) in order to conduct the study. Electrostimulation devices used to perform the acupressure had CE documents and 9342 ECC certificates from the TR Ministry of Health. Written institutional permissions (45.097.484-1342-1499, 2012/096, 606-2278) were obtained from three dialysis centers where the study was conducted. The patients participating in the study were informed about the aim of the study and their verbal and written informed consents were obtained.

AUTHORS' DISCLOSURE STATEMENT

The authors declare that they have no competing interests.

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LIMITATIONS OF THE STUDY

Blinding and cross over could not be performed as part of the method of the study due to operation principle of the electrostimulation device.

AUTHOR CONTRIBUTIONS

All the authors equally contributed to intellectual content of the manuscript as well as proposal of design, data collections, data analysis, and drafting the manuscript.

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