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ORIGINAL ARTICLE

Effects of Thermotherapy on the Quality of Life and Biochemical Parameters in Hemodialysis Patients with Uremic Pruritus

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ABSTRACT

Introduction and objective: Uremic pruritus is a common symptom in patients under hemodialysis. The exact cause of uremic pruritus is not yet known. Although effective treatments are available, there is not still a commonly accepted treatment for this disorder. The present study was aimed at examining the effects of thermotherapy on the quality of life (QOL) and biochemical parameters in hemodialysis patients with uremic pruritus.

Patients and methods: In this experimental study, a total of 40 men under hemodialysis suffering from uremic pruritus were randomly selected and divided into an experimental group (thermotherapy) and a control group (no exposure to heat). The experimental group were exposed to far-infrared radiation (FIR) at 40 °C in 15-minute sessions, three times a week, in total for 18 sessions. The Severity of Pruritus Scale (SPS), the Kidney Disease Quality of Life Instrument (KDQOL), and the ItchyQoL were completed by the participants before the start of intervention, one month after the start of intervention, and at the end of intervention. The data were analyzed using SPSS22.

Results: Significant differences were observed between the intervention and control groups in all the criteria for assessing uremic pruritus, including history of symptoms, daily activities, QOL, effects on sleep, emotional aspects, and severity of pruritus ($p<0.001$). In addition, significant improvements were found after the intervention in the criteria for assessing the QOL of the patients ($p<0.001$). Moreover, improvements in the calcium and phosphorus levels were observed in the intervention group in comparison with the control group.

Conclusion: Thermotherapy is effective in reducing the severity of pruritus and increasing the QOL of patents with this problem. Therefore, it can be used as a complementary method in treating patients with uremic pruritus who also experience a reduction in their QOL.

Keywords: Hemodialysis, Thermotherapy, Uremic pruritus, Quality of life, Biochemical parameters

INTRODUCTION

Hemodialysis patients experience multiple complications in all aspects of their lives as a result of the symptoms of the disease and the process of hemodialysis, and the qualitative standards of life can be considered rather unique in this group of patients. On the one hand, the problems and complications resulting from the disease lead to serious changes in the patients' diet, water intake, and rest-activity patterns. On the other hand, it has a costly and time-consuming process that limits the life of hemodialysis patients in both individual and social domains (1, 2).

Uremic pruritus is a common complication experienced by patients under hemodialysis that is due to renal failure and the subsequent hemodialysis. Uremic pruritus is observed in 25% of patients with chronic kidney disease (CKD) and 50-90% of people under hemodialysis at mild to severe levels [3]. It is observed with more severity in the last stages of renal failure, and can seriously affect the quality of life (QOL) of patients (3).

The QOL of patients in the last stages of renal failure is heavily dependent on dialysis adequacy and vascular access to have a high quality hemodialysis. As the disease progresses, the quality of hemodialysis is reduced; this leads to the sedimentation of combustible compounds in different areas of the patient's skin, therefore causing uremic pruritus (4).

Despite the high prevalence of uremic pruritus and its significant effects on the QOL of patients, it has not received enough attention in the research domain (5).It is difficult to control uremic pruritus due to limited number of instruments and treatment methods for this purpose. The research evidence shows that local therapies are frequently used to treat simple pruritus, but they are often effective only temporarily (1).

Today, most patients look for methods that can treat the symptoms of pruritus without the use of medications. Therefore, healthcare providers, especially nurses who are in direct contact with patients can use complementary methods to enhance the treatment of pruritus (6).

Among the complementary therapies for pruritus, thermotherapy using FIR that is out of the human vision has received more attention in recent years. It is important to note that when using thermotherapy, medication therapies and the routine care processes for the patients are continued and are not interfered by thermotherapy (7).

FIR is a form of electromagnetic radiation with shorter wavelengths that is created using a lamp emitting the waves. It has been proved that FIR through thermotherapy has an important role in treating many vascular diseases,

widening of blood vessels, and increasing the blood flow in the radiated area (8).

In addition, thermotherapy using the repeated sauna treatment can improve the coronary arteries in the infarcted area (9). Thermotherapy using Waon therapy can improve vascular flow and increase endothelial function through increasing endothelial nitric oxide synthase (10). It has been shown that modern therapies, such as the use of thermotherapy to treat chronic fatigue syndrome (CFS) through creating a dry sauna using FIR can significantly reduce fatigue, pain, and low-grade fevers in patients; repeated thermotherapy has also sedative effects and leads to increased appetite and reduced complaints of mild depression in patients (11).

FIR effectively penetrates the subcutaneous tissues and reduces discomfort (8). It has been particularly maintained that thermotherapy using FIR can increase the blood flow and cell metabolism (12), reduce pain, lead to body tissue regeneration, increase oxygen delivery, and activate the immune response (13).

The process of controlling and reducing uremic pruritus in hemodialysis patients, has recently become focused on thermotherapy, and the research evidence has shown that thermotherapy using FIR significantly improves dialysis adequacy (14), therefore it can have positive effects on the QOL of patients under hemodialysis. Evaluation of the QOL of patients is useful in assessing the effectiveness of interventions as well as their cost-effectiveness (15). In addition to creating clinical and financial burdens, cardiovascular disease can threaten the health-related QOL of patients. Despite the increased interest in thermotherapy, no study in Iran has so far focused on its effects of uremic pruritus and the QOL of hemodialysis patients, Therefore, the goal of the present study is to examine the effects of thermotherapy on uremic pruritus and QOL among patients under hemodialysis.

METHODS

The present randomized, clinical trial was aimed at examining the effects of thermotherapy on the QOL and biochemical parameters of hemodialysis patients with uremic pruritus in the hemodialysis ward of Shahid Sadoughi hospital, Yazd, Iran. The study sample included a total of 40 patients who were randomly divided into an experimental and a control group. Sample size was determined as 40 (20 in each group) based on the article, titled “Effects of Thermotherapy on Uremic Pruritus and Biochemical Parameters in Patients under Hemodialysis” (16), using the G*Power software ($\alpha = 0.05$; effect size = 0.8; Power = 0.80). In this experimental research, a Pretest-Midtest-Posttest design with a control group was used. Initially, a total of 81 hemodialysis patients with uremic pruritus were selected using a multistage random sampling method, of which 32 patients were excluded according to the inclusion criteria. The remaining 49 patents were randomly divided into an intervention (n=24) and a control group (n=25). Finally, 21 and 20 patients remained in the intervention and control groups, respectively. Severity of uremic pruritus and biochemical parameters were assessed at three time points of pretest, midtest, and posttest. Data were gathered using general instruments (a demographic questionnaire and a patient clinical scale) and specific instruments to collect laboratory data, including the Severity of Pruritus Scale (SPS), the Kidney Disease Quality of Life Instrument (KDQOL), and the ItchyQoL. The data were analyzed using SPSS22 (released 2007; SPSS for Windows, SPSS Inc., Chicago, IL, USA). The present clinical trial was registered in Iranian Registry of Clinical Trials under the number IRCT2017041333245N2 with the following number for ethics: IR.Shahed.REC.1395.195.

RESULTS

In the present study, a total of 40 patients were selected among male hemodialysis patients in the hemodialysis ward of Shahid Sadoughi hospital, Yazd, Iran. The mean age of participants in the control and experimental groups was 57.70 years and 55.65 years, respectively. The mean weight of participants in the control and experimental groups was 69.45 kg and 71.95 kg, respectively. The mean height of participants in the control and experimental groups was 172.75 cm and 169.65 cm, respectively. In terms of education level, in the control group, 13 participants had primary education, 6 had middle school education, and 1 had high school education; and in the experimental group, 10 participants had primary education, 5 had middle school education, and 5 had high school education or higher. In terms of marital status, in both groups, 1 participant was single and 19 were married. In terms of financial status, 17 participants in the control and 14 in the experimental group had an income lower than the standard level, and 3 participants in the control group and 6 in the experimental group had had an income in the standards level. In terms of employment, 4 and 16 participants in both groups were retired and unemployed, respectively. In terms of cigarette smoking, 5 participants in the control group and 3 participants in the experimental group smoked cigarettes. 10 participants in the control group and 7 participants in the experimental group used high blood pressure medications. The results show that both groups were similar in terms of demographic characteristics (P values ranging from 0.143 to 1).

Table 1 presents the means and standard deviations of the study criteria, including uremic pruritus, effects of pruritus on sleep, history of using antipruritic drugs, and effects of pruritus on everyday activities in both groups, assessed before intervention, one month after the start of intervention, and after the end of intervention, as well as comparisons between the two groups. Comparison of the two groups in uremic pruritus and its effects on sleep and everyday activities, showed a significant reduction in the experimental group, however, no significant difference was found between the two groups in history of using antipruritic drugs.

The means and standard deviations of the study criteria, assessed before the start of intervention, one month after the start of intervention, and after the end of intervention and comparisons between the two groups are presented in Table 2.

Table 1. Means and standard deviations of uremic pruritus, effects of pruritus on sleep, history of taking antipruritic, and effects of pruritus on everyday activities in both groups, assessed before intervention, one month after the start of intervention, and after the end of intervention, as well as comparisons between the two groups.

Criteria	Control group			Experimental group			Statistical test
	Time of assessment			Time of assessment			
	Before the intervention	One month after the start of intervention	After the end of intervention	Before the intervention	One month after the start of intervention	After the end of intervention	
Uremic pruritus	10.6(2.5)	11.2(2.35)	10.8(1.9)	10.55(2.1)	9.3(2.03)	8.2(2.2)	F(2)=9.7, P<0.001 Eta=0.203
History of using antipruritic drugs	2.15(0.48)	2.15(0.48)	2.15(0.48)	2.25(0.55)	2.10(0.44)	2.10(0.48)	F(2)=1.8, P=0.169, Eta=0.046
Effects of pruritus on sleep	2.1	2.2	1.6	2.4	1.7	1.6	F(1.6)=10.9, P<0.001, Eta=0.223
Effects of pruritus on everyday activities	0.25 (0.63)	0.90 (1.16)	0.80 (1.64)	050 (0.88)	0.50 (1.05)	0.00 (0.00)	F(2)=4.46, P=0.015, Eta=0.105

Table 2. Means and standard deviations of the study criteria, assessed before the start of intervention, one month after the start of intervention, and after the end of intervention and comparisons between the two groups.

Criterion	Control group			Experimental group			Statistical test
	Time of assessment			Time of assessment			
	Before the intervention	One month after the start of intervention	After the end of intervention	Before the intervention	One month after the start of intervention	After the end of intervention	
Effects of pruritus on QOL	0.45 (0.60)	0.90 (0.78)	1.15 (1.08)	0.70 (0.80)	0.25 (0.44)	0.00 (0.00)	F(2)=15.798, P<0.001 Eta=0.296
Description of emotional aspects	3.9 (2.06)	4.4 (2.13)	4.6 (1.81)	4.6 (1.56)	2.6 (1.26)	2.4 (1.14)	F(1.26)=28.35, P<0.001, Eta=0.427
Current severity of pruritus	4.8 (1.36)	5.1 (1.63)	5.5 (1.39)	5.15 (1.53)	3.2 (1.00)	2.2 (1.11)	F(2)=34.85, P<0.001, Eta=0.478
Severity of pruritus at the worst level	7.3 (1.38)	7.3 (1.34)	7.6 (1.27)	7.7 (1.33)	6.6 (1.18)	5.5 (1.27)	F(2)=77437, P<0.001, Eta=0.203498
Severity of pruritus at the lowest level	3.25 (0.55)	3.35 (0.81)	3.20 (0.76)	3.35 (0.58)	2.8 (1.00)	1.4 (1.27)	F(1.41)=19.42, P<0.001, Eta=0.337
Quality of physical health	30.95 (2.35)	46.30 (1.52)	46.5 (2.68)	33.45 (4.94)	41.9 (7.2)	41.1 (6.7)	F(1.66)=41.99, P<0.001, Eta=0.525
Quality of feelings and emotions	89.85 (3.67)	71.75 (3.76)	72.85 (5.31)	90.15 (8.19)	72.35 (9.10)	67.9 (9.5)	F(1.66)=41.99, P<0.001, Eta=0.525
Improvement of clinical records	34.85 (4.24)	34.90 (2.46)	35.95 (2.66)	39.45 (7.25)	34.55 (8.04)	31.55 (7.29)	F(1.70)=29.48, P<0.001, Eta=0.437
Limitations in everyday activities	24.00 (4.05)	21.45 (2.21)	23.20 (2.74)	26.45 (6.22)	25.45 (6.73)	25.20 (6.13)	F(1.64)=3.10, P=0.003, Eta=0.076
Sexual activity	1.70 (0.470)	1.30 (0.470)	1.55 (0.510)	1.10 (0.307)	1.15 (0.366)	1.70 (0.470)	F(2)=7.09, P<0.001, Eta=0.157
Sexual disorders	8.4 (1.23)	8.7 (0.86)	8.1 (1.33)	8.4 (1.95)	7.8 (1.96)	7.6 (2.41)	F(2)=1.74, P=0.182, Eta=0.044
Sleep quality	8.9 (1.94)	7.8 (1.39)	8.8 (1.36)	8.8 (1.79)	8.2 (1.85)	8.45 (2.45)	F(2)=0.902, P=0.410, Eta=0.023
General and family relationships	5.50 (1.05)	6.30 (0.97)	5.4 (0.75)	6.6 (2.13)	5.85 (1.56)	5.75 (1.55)	F(1.72)=6.31, P=0.005, Eta=0.143
Job quality	3.00 (0.72)	3.50 (0.51)	3.50 (0.51)	3.2 (1.01)	3.05 (0.94)	3.25 (0.91)	F(2)=6.12, P=0.003, Eta=0.139
Satisfaction with the received care	8.50 (1.10)	8.55 (0.94)	8.15 (0.810)	8.60 (2.21)	8.20 (1.93)	8.40 (1.87)	F(1.66)=1.92, P=0.161, Eta=0.048
Quality of pruritus symptoms	15.50 (2.80)	15.60 (2.68)	14.85 (2.00)	17.65 (3.55)	16.35 (2.77)	10.80 (2.94)	F(2)=16.76, P<0.001, Eta=0.306
Quality of everyday activities	35.25 (4.39)	34.45 (4.22)	33.20 (3.65)	38.40 (6.72)	36.30 (6.89)	43.25 (6.74)	F(2)=802, P=0.452, Eta=0.021
Quality of feelings and emotions (the ItchyQoL)	33.05 (4.17)	34.10 (5.03)	34.5 (4.94)	36.65 (6.73)	34.25 (6.83)	30.30 (6.96)	F(2)=10.6, P<0.001, Eta=0.218
QOL of patients with pruritus	83.80 (5.54)	84.15 (6.93)	82.20 (5.52)	92.70 (12.25)	86.90 (12.57)	75.35 (12.65)	F(2)=13.215, P<0.001, Eta=0.258

Based on the Comparison between the two groups at the three stages of before, during, and after the intervention, the assumption of sphericity was confirmed using the Mauchly's test. The descriptive statistics showed that the means and standard deviations of most criteria at the three stages of assessment were significantly different between the two groups. However, according to the descriptive statistics, the means and standard deviations of sexual disorders, sleep quality, satisfaction with the received care, and quality of everyday activities at the three stages of assessment were not significantly different between the two groups.

Table 3. Levels of biochemical parameters in the experimental and control groups before the start of intervention, one month after the start of intervention, and after the end of intervention, and the results of comparisons between the two groups.

Biochemical parameter	Time of assessment	Control group	Experimental group	P-value
Calcium	Before	10.02	9.78	0.08
	During	10.09	10.00	0.07
	After	9.87	9.54	0.02
Phosphorus	Before	5.50	5.06	.39
	During	5.01	4.35	0.11
	After	5.01	4.70	0.38
Albumin	Before	3.97	3.72	0.03
	During	3.98	3.69	0.04
	After	3.98	3.78	0.09
Alkaline phosphatase	Before	90.76	81.40	0.26
	During	89.71	77.40	0.17
	After	93.24	80.15	0.38
Urea	Before	1.39	1.54	0.20
	During	1.45	1.64	0.13
	After	1.46	1.75	0.02
Hematocrit	Before	32.49	30.45	0.19
	After	32.11	29.34	0.03
Hemoglobin	Before	11.01	10.22	0.14
	After	10.98	9.91	0.01
Parathyroid hormone (PTH)	Before	322.4	154.33	0.02
	After	431.57	240.64	0.16
Calcium × phosphorus ratio	Before	55.51	49.59	0.35
	During	51.19	43.24	0.09
	After	49.38	44.42	0.26

In the experimental group, all the biochemical parameters changed after the intervention in comparison with the pre-intervention period.

DISCUSSION

The goal of the present study was to examine the effects of thermotherapy using FIR on uremic pruritus and QOL among male hemodialysis patients in the hemodialysis ward of Shahid Sadoughi hospital, Yazd, Iran in 2018. The study findings are consistent with some of the previous findings on this topic. In a study by et al. (2009), the effects of thermotherapy using FIR were compared with those of a non-thermal therapy on uremic pruritus and biochemical parameters in patients under hemodialysis. In this randomized, double-blind trial, 41 hemodialysis patients with uremic pruritus were divided into a thermotherapy and a control group. The thermotherapy group received FIR at 40 °C for 15 minutes, once a day, twice a week, in a total of 18 sessions. While, the control group received routine treatment programs, including acupuncture. The results indicated significant improvements in the severity of uremic pruritus in both groups, while a relatively large reduction in uremic pruritus was observed in the thermotherapy group. In addition, a significant decrease was found in the calcium × phosphorus ratio in the serum of patients in the thermotherapy group. Finally, the authors concluded that FIR through reducing the serum calcium × phosphorus ratio as one the most important causes of pruritus had led to a relative improvement in the symptoms of the patients. But, they emphasized that more studies with larger sample sizes and using long-term interventions would be needed to confirm their results.

Yaghoubi et al. (2012), Mohammadpoor et al. (2016), and Young et al. (2010), found the effectiveness of FIR on pain reduction (30), reduction in systolic and diastolic blood pressure, and a sudden increase in the tensile strength of the skin within one or two weeks, respectively. But, the results of a study by Tabatabaei et al. (2009) showed a reduction in the severity of pain and an increase in the clinical range of motion in the thermotherapy group; however, they found no significant differences between the two groups. The results of studies by Elizabeth and et al. indicated the effectiveness of non-pharmacological therapies in reducing uremic pruritus; this emphasize that non-pharmacological therapies can be effective for treating hemodialysis patients suffering from uremic pruritus, and that the use of complementary therapies to treat this problem is recommended.

Some of the previous studies have led to consistent results with those of the present study in terms of QOL et al. (2012), examined the relationship between severe pruritus, psychological complications, and QOL in 20 patients with eczema, 20 patients with psoriasis, 20 patients with urticaria, 12 patients with congenital pruritus, 11 patients with pruritus caused by renal failure, and 20 patients with cardiovascular disease, using a researcher-made checklist assessing age, gender, diagnosis, severity of symptoms, sleep quality, depression, anxiety, non-specific somatic

symptoms and QOL under pruritus. They found a significant relationship between pruritus and QOL in patients with urticaria. In the patients with severe pruritus, quality of sleep had been influenced more than depression symptoms. In addition, the effects of anxiety were more severe than those of non-specific somatic complications. Finally, the authors concluded that the multidimensional nature of pruritus led to depression, anxiety, and reduced QOL; this is in line with the previous reports (8).

conducted a study, titled “Thermotherapy in Hemodialysis Patients: Effects of Far Infrared Radiation on Dialysis Adequacy among Hemodialysis Patients.” Et al. (2011), They found significant improvements in the group receiving FIR ($p<0.05$) compared to the control group. They concluded that thermotherapy significantly improved dialysis adequacy, and emphasized the use of FIR in treating patients under hemodialysis.

In their experimental study, Young et al. (2010), found no significant difference in the tensile strength between the FIR and control groups. However, they found a sudden increase in tensile strength in the FIR group during one and two weeks ($p=0.033$). In addition, tensile strength during two weeks was significantly higher in the FIR group compared to the control group ($p=0.049$). This results of this study indicates that in short-term, the FIR can have a reducing effect in the generation of inflammatory changes and increase of the tensile strength of the skin.

conducted an experimental study, titled “Effects of Repeated Thermotherapy on the QOL of Patients with Diabetes Mellitus Type 2”(2010), and examined the effects of thermotherapy on the QOL of patients with diabetes mellitus type 2. Their intervention included 20-minute sessions of therapeutic FIR sauna, three times a week, during a three months period. In this study, the Short Form-Health Survey version 2 (SF-36v2) and the visual analogue scale (VAS) were completed by the participants. Pre-intervention assessments of the parameters were conducted 1 week before the start of intervention, and post-intervention assessments were conducted within 1 to 3 days following the last session of the sauna. The results according to the data from the SF-36v2, indicated improvements in physical health, general health, and social functioning of the intervention group. In addition, analysis of the data from the VAS indicated improvements in stress and fatigue. It was finally concluded that the FIR sauna can improve the QOL of people with diabetes type 2.

CONCLUSION

Thermotherapy is significantly related to uremic pruritus and QOL, and the patients who received thermotherapy experienced relative improvements in their uremic pruritus symptoms and QOL. In addition, examination of biochemical parameters indicated a significant reduction in the calcium × phosphorus ratio. Therefore, thermotherapy could be regarded as a complementary therapy to treat uremic pruritus and increase QOL in patents under hemodialysis.

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