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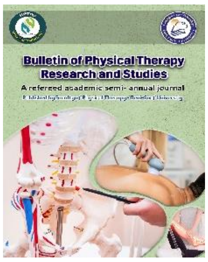

Acupressure Versus Transcutaneous Electrical Nerve Stimulation on Pain and Quality of Life Intra Dialysis

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Running Title: Acupressure Versus Transcutaneous Electrical Nerve Stimulation on Pain and Quality of Life Intra Dialysis.

Abstract:

Background: Complications from hemodialysis lead to physical problems and pain that lower quality of life (QOL). by contrasting the effects of acupressure and transcutaneous electrical nerve stimulation on pain and quality of life intra dialysis. In hemodialysis patients, both may lessen discomfort and enhance quality of life; however, further studies are required to determine which is more beneficial.

The Aim of research: The main aim of this research was to compare between effect of Acupressure and Transcutaneous Electrical Nerve Stimulation [TENS] on pain and quality of life intra dialysis.

Methodology: A cohort of sixty men, ages 50 to 60, who had hemodialysis were included in the study. They were chosen from the hemodialysis unit of the Maghagha Central Hospital in Minya. Patients were split equally into groups A and B. Group A received acupressure treatments three times a week. For eight weeks, Group B received TENS three times a week. the pain pressure threshold (PPT) ,the (BPI) brief pain inventory and The KDQOL [SF-36] questionnaire were used to evaluate them.

Results: Comparing the pre- and post-study results showed that both groups' their pain pressure threshold increased significantly, Both groups' short pain inventory scaling decreased and QOL as measured by the KDQOL [SF-36] questionnaire improved as well. but TENS had a more statistically significant advantage over Acupressure and more effective in relieving pain and improving quality of life QOL.

Conclusion: From results of the current research, it supports the application of TENS has more significant effect than Acupressure in relieving pain, improving quality of life intra dialysis. It is preferable to use both together.
Keywords: CKD; Intra dialysis; Hemodialysis; Acupressure; TENS; Pain.

Introduction:

Chronic kidney disease (CKD) is defined as having abnormalities in kidney structure or function that persist for more than three months, impacting health. These abnormalities can be identified clinically through various criteria, with any one criterion being sufficient for a CKD diagnosis. The criteria involve a glomerular filtration rate (GFR) below 60 mL/min/1.73 m², signs of kidney damage such as albuminuria (albumin excretion rate of 30 mg or more per 24 hours), a urinary albumin-to-creatinine ratio (UACR) of 30 mg/g or higher, irregularities in urine sediment, electrolyte disturbances and other complications from tubular disorders, structural abnormalities identified through imaging or histology, or a history of kidney transplantation [1].

With hemodialysis making up around 69% of all kidney replacement therapy and 89% of all dialysis, it is the most widely used type of kidney replacement therapy worldwide [2]. Hemodialysis can be extremely painful and uncomfortable, negatively impacting the quality of life for patients with end-stage renal disease (ESRD), despite being essential for their health. Patients undergoing hemodialysis may experience three types of pain: (a) discomfort from the procedure itself; (b) discomfort related to the vascular access; and (c) pain caused by the renal disease or its complications. Effective pain management is crucial during hemodialysis to enhance patient compliance, improve the overall treatment experience, and promote better physical, mental, and emotional well-being [3].

Patients with (CKD) chronic kidney disease on dialysis experience compromised muscle strength, balance, and functional capacity, which makes hemodialysis associated with major morbidities. The patients' respiratory muscle strength, balance, upper and lower extremities muscular strength, pulmonary function, and functional exercise capacity were all impaired when compared to controls. They also engaged in less physical exercise and had stronger perceptions of dyspnea and kinesiophobia. Patients should be referred to cardiopulmonary rehabilitation programs [4].

Since chronic pain is prevalent and frequently severe in a variety of CKD populations, it is crucial to make chronic pain management a top clinical and scientific goal. Future research should focus on enhancing our understanding of the factors contributing to chronic pain and assessing the effectiveness of pain management strategies. Special attention should be given to how these factors impact patients' overall symptom burden, functional ability, and quality of life [5].

When used in conjunction with complementary and alternative medicine, acupressure helps lessen suffering and pain in elderly patients receiving extracorporeal lithotripsy. It can be incorporated into routine therapeutic treatments for senior patients to reduce their need for medication, minimize pain and suffering during noninvasive operations, and avoid the negative effects of pharmacology [6].

Acupressure requires applying physical pressure to acupoints, or specific pressure points that run along the meridians. The meridians of the human body are the routes that preserve Qi stability and, in turn, promote health. Every meridian in the human body is associated with different tissues and organs. Pressure applied to a particular place on the meridian helps to both locally relieve pain and lessen pain from other sections of the body [7].

Strong non-painful TENS given within or near the pain site results in clinically significant reduction in pain intensity during or shortly after therapy, according to the meta-analysis, which also shows no reports of serious adverse effects. There is some reasonably certain data to back up this statement. Clinicians, policymakers, and funders should consider TENS as an extra treatment option to core care for temporary, instantaneous pain relief, regardless of the patient's condition. Patients should be advised to tailor TENS treatment to meet their particular needs [8].

By modifying neurotransmitters and receptors at the stimulation site and its higher levels, such as the brain, brainstem, and spinal cord, TENS may be able to reduce pain. In addition. Optimal stimulation parameters, like frequency and intensity, are critical for optimizing the analgesic effects of TENS, as most clinical research has demonstrated. TENS is useful in relieving neuropathic pain [9].

The purpose of this study was to compare the impact of acupressure and transcutaneous electrical nerve stimulation (TENS) on pain and quality of life while receiving dialysis.

Methodology:

Sample size calculation was determined using G*Power version 3.1.9.7 and previous research results (Cevik and Taşcı, 2020). There was a correlation between the VAS and KDQOL ratings (r-value = -0.35), with an effect size (f = 0.35). With an alpha level of(0.05) and a beta level of (0.2), ie., power = 80%, the expected sample size (n) was 60 patients, or 30 patients each group. The effect size (d) was calculated using data from a previous study, and it was found to be 0.35.

The current study comprised sixty male patients who had received hemodialysis treatments between six months and two years prior. They were hired from the Maghagha Central Hospital's hemodialysis unit. The research, which had the NCT06098443 number on clinical trials.gov, was conducted between November 2023 and April 2024. The research project received approval in December 2023 from Cairo University's Faculty of Physical Therapy Research Ethical Committee (No: P.T.REC/012/004482).

The researchers made sure that each participant provided informed written consent before starting the trial with patients. As part of this process, comprehensive information regarding the goals of the study and the importance of the study protocols was provided. The following were the inclusion criteria: sixty individuals with stage 5 renal insufficiency who have been receiving hemodialysis for at least six months to two years. The following were the inclusion criteria: Individuals who scored between 7 and 10 points on the brief pain inventory (BPI) and reported having lower limb pain. The range of the body mass index was 25 to 29.9. Their ages varied from fifty to sixty years old. Every patient was fully managed by a physician. Individuals did not require lower limb dialysis grafting. elevated hemoglobin level (>10 mg/dl).

Measures of outcomes: Before and after application, all patients were evaluated using the following tools: the pain pressure threshold (PPT), the brief pain inventory (BPI) and the KDQOL [SF-36] questionnaire.

Treatment protocols

The sixty male participants, based on their hemodialysis prevalence were randomly assigned into two equal-sized groups.

Thirty patients in Group A received acupressure treatments. The acupressure points were identified, and for eight weeks, three times a week, pressure was applied for three minutes on each point. Patients were told that when acupressure was applied, they experienced pain and gentle vibrations. Patients were told that feeling the acupressure device's vibrations just a little bit is enough. First, symmetrically, it was felt in the right leg, right knee, and left leg. For eight weeks, patients had three times a week acupressure. Thirty minutes after applying, the patients were questioned about the level of pain [10].

Thirty patients receiving TENS (transcutaneous electrical nerve stimulation) were part of group B. TENS is a non-invasive pain management technique that uses electrodes applied to the skin to administer small electrical currents to reduce pain [3].

Intensity up to patient tolerance three times per week for 8 weeks.

In order to induce painless muscle contraction, the pulse amplitude was individually adjusted from 5 to 40 mA for 100 microseconds throughout a length of 30 minutes at a frequency of 100 Hz [8].

Statistical analysis:

- To compare the characteristics of the subjects between groups, an unpaired t test was used.
- A mixed MANOVA was used to assess the effects of treatment (between groups) and time (pre versus post), as well as the interaction between treatment and time on the mean values of the PPT, BPI, and KD QOL SF-36.
- For the multiple comparison that followed, post-hoc analyses using the Bonferroni correction were performed.
- A significance threshold of $p < 0.05$ was applied to every statistical test.

Windows version 25 of the statistical package for social sciences (SPSS) was used to conduct the statistical analysis.

Results

Features of the subject: The demographic details of the two research groups are shown in Table [1]. Age, weight, height, and BMI did not differ statistically significantly across the groups [$p > 0.05$].

Effect of treatment on PPT, BPI, KD QOL SF-36

Within group comparison

PPT increased significantly in both groups after treatment when compared to pretreatment levels ($p = 0.001$). (Table II). Group A experienced a PTT change of 46.05%, while Group B experienced a PTT change of 78.36%.

When comparing the BPI of both groups' pretreatment and posttreatment, there was a substantial drop ($p = 0.001$) in BPI. (Table 3). Group A had a BPI percent change of 42.56%, while group B had a BPI percent change of 52.36%.

The KD QOL SF-36 significantly increased in both groups after treatment as compared to before (p = 0.001). (Table 4) shows that although group A's KD QOL SF-36 percent change was 25.51%, group B's KD QOL SF-36 percent change was 33.75%.

Comparison between groups

After treatment, group A and group B's mean PPT differences were -0.68 kg. After therapy, group B's PPT significantly increased in comparison to group A's (p = 0.003). (Table 2).

After therapy, group A and group B's mean BPI differences were 0.94. After therapy, group B's BPI significantly decreased in comparison to group A's (p = 0.005). (Table 3).

After therapy, group A and group B's mean KD QOL SF-36 differences were -6.90. After therapy, group B's KD QOL SF-36 significantly increased in comparison to group A's (p = 0.001). (Table 4)

Table 1 shows the mean age, height, weight, and BMI comparison between groups A & B.

	Group A	Group B	(MD)	t-value	p-value	(Sig)
	$\overline{X} \pm$ SD	$\overline{X} \pm$ SD				
Age (years)	54.60 ± 3.29	55.50 ± 2.53	-0.9	-1.18	0.24	**NS**
Weight (kg)	72.53 ± 4.09	74.00 ± 3.69	-1.47	-1.45	0.15	**NS**
Height (cm)	166.47 ± 4.66	167.83 ± 3.75	-1.36	-1.25	0.19	**NS**
BMI (kg/m²)	26.21 ± 1.82	26.26 ± 0.76	-0.05	-0.14	0.89	**NS**

$\overline{X}$: Mean SD: Standard deviation t value: Unpaired t value
MD: Mean difference NS: Non significant p value: Probability value

Table 2 shows the group A & B means PPT before and after treatment.

PPT (kg/cm2)	Pre treatment	Post treatment	MD	% of change	P-value	(Sig)
	$\overline{X} \pm$SD	$\overline{X} \pm$SD				
Group A	3.10 ± 0.76	4.53 ± 0.88	-1.43	46.05	0.001	**S**
Group B	2.92 ± 0.68	5.21 ± 0.81	-2.29	78.36	0.001	**S**
(MD)	0.18	-0.68				
P-value	0.33	0.003				
(Sig)	**NS**	**S**				

$\overline{X}$: Mean SD: Standard deviation t value: Unpaired t value
MD: Mean difference NS: Non significant p value: Probability value

Table 3: Mean BPI for Groups A & B before and after treatment.

BPI	Pre treatment	Post treatment	(MD)	% of change	P-value	(Sig)
	$\bar{X}$ ±SD	$\bar{X}$ ±SD				
Group A	8.13 ± 1.20	4.67 ± 1.15	3.46	42.56	0.001	**S**
Group B	7.83 ± 1.42	3.73 ± 1.31	4.10	52.36	0.001	**S**
(MD)	0.3	0.94				
P-value	0.38	0.005				
(Sig)	**NS**	**S**				

$\bar{X}$: Mean **SD: Standard deviation** **t value: Unpaired t value**
MD: Mean difference **NS: Non significant** **p value: Probability value**

Table 4 shows the group A & B mean KD QOL SF-36 before and after treatment.

KD QOL SF-36	Pre treatment	Post treatment	(MD)	% of change	P-value	(Sig)
	$\bar{X}$ ±SD	$\bar{X}$ ±SD				
Group A	55.67 ± 3.68	69.87 ± 7.59	-14.20	25.51	0.001	**S**
Group B	57.40 ± 5.09	76.77 ± 6.39	-19.37	33.75	0.001	**S**
(MD)	-1.73	-6.90				
P-value	0.14	0.001				
(Sig)	**NS**	**S**				

$\bar{X}$: Mean **SD: Standard deviation** **t value: Unpaired t value**
MD: Mean difference **NS: Non significant** **p value: Probability value**

Discussion:

Comparing the effects of Acupressure and TENS on pain and quality of life during dialysis was the primary goal of this study.

Hemodialysis patients frequently complain of pain, mostly musculoskeletal and intradialytic pain, which makes it difficult for them to do ADLs and renders them incapable. There was a lot of pain in the trunk, upper, and lower limbs. Additionally, there was a higher frequency of severe pain during hemodialysis and functional pain interference, primarily with regard to general activity, mobility, and disposition [11].

Peripheral neuropathy, alterations in the musculoskeletal system, cardiovascular disorders, headaches from hemodialysis, cramping in the muscles, and issues connected to fistulas during, after, and after dialysis are some of the causes of pain in kidney patients [10].

Hemodialysis leads to a decreased quality of life for patients due to various factors, such as physical limitations from long and frequent sessions, strict dietary and fluid intake restrictions, psychological and emotional stress including anxiety, depression, and a sense of loss of control. It also negatively impacts social life and work capacity, and poses potential medical complications like low blood pressure, muscle cramps, and increased risk of infections. Additionally, the financial burden of hemodialysis treatment, medication costs, and loss of income adds to the challenges patients face. The severity of these effects varies based on the patient's overall health, support system, and personal coping mechanisms[12].

These days, pharmacological, surgical, or integrative techniques are used to treat ESRD patients' pain. One of the main primary palliative care competences for healthcare professionals is pain control. Nephrology professionals can learn the fundamentals of pain management from this review. By using these abilities to identify nociceptive and neuropathic pain syndromes and to take proper medical histories, physicians can improve both the outcomes of healthcare systems and the general health of their patients [13].

Physical therapists and other professionals have used Acupressure treatment to treat LBP because it is believed to release blockages that prevent energy flow and relieve pain by enhancing circulation and nutrition [14].

Applying physical pressure to different body parts to enhance energy circulation and balance is known as acupressure, a pain management method. This treatment works similarly to acupuncture in that it stimulates internal energy flow by applying pressure to particular body parts using the fingers, hands, palms, wrists, and knees. Acupressure is a noninvasive, safe, and effective treatment method [10].

With transcutaneous electrical nerve stimulation (TENS), large-diameter afferent nerves receive impulses that are transported by a transcutaneously produced, pulsed electric current. It then results in presynaptic inhibition of nociceptive A delta and C fibers, which are implicated in the substantia gelatinosa's pain gates and so have an impact on pain regulation. Since pruritus and pain are comparable at both the peripheral and central levels, TENS may also have an antipruritic impact in conditions causing itching skin. Thus far [15].

Regarding acupressure's effects, the current study showed that applying acupressure for eight weeks resulted in a considerable improvement in pain as measured by an increase in pain pressure threshold (PPT), with a change percentage of 46.05%.additionally, the brief pain inventory (BPI) showed a 42.56% change in percentage.

Because acupressure stimulates the autonomic nervous system, it may increase the body's natural synthesis of sedatives and analgesics, which could account for the improvement in pain [7].

As one of the main goals of treatment for end-stage renal disease (ESRD), efforts to improve quality of life (QOL) in hemodialysis patients have prompted healthcare professionals to do additional research in order to uncover various aspects of QOL and practical means of enhancing these in the recent past [15].

The current study's findings on the effects of acupressure showed a significantly improved quality of life, as measured by KD QOL SF-36 questionnaire, with a change percentage of 25.51%.

This result comes in consistent with the study done by Gurusamy and Gandhimathi (2020) [16]. which, when compared to the baseline data, showed comparable results demonstrating a significant improvement in QOL of patients receiving hemodialysis with late-stage renal illness after 4 weeks of acupressure therapy, and it was sustained until the completion of 8 weeks of acupressure therapy.

This result comes in consistent with the study done by Suandika etal (2021) [17]. It produced comparable findings indicating that acupressure is a noninvasive treatment that improves health and positively affects hemodialysis (HD) patients' quality of life (QOL)..

Regarding TENS's effects, the current study indicated that using it for eight weeks significantly reduced pain as measured by an increase in pain pressure threshold (PPT), with a change percentage of 78.36%.additionally, the brief pain inventory (BPI) showed a 52.36% change in percentage terms.

Transcutaneous electrical nerve stimulation (TENS) may have an impact on pain control by producing presynaptic inhibition of nociceptive A delta and C fibers involved in the substantia gelatinosa's pain gates, which could account for the improvement in pain [14].

The results of current study has similar effect as the results of the study done by García-López etal .,2024 [18]. Patients with fibromyalgia syndrome (FMS) benefit from (TENS) transcutaneous electrical nerve stimulation intervention in terms of decreased pain and disability as well as improved physical quality of life (QOL).

The results of this study indicate that TENS has a considerable positive impact on quality of life. The KD QOL SF-36 questionnaire showed a 33.75% change in percentage terms.

This result comes in consistent with the study done by Katirci Kirmaci etal., (2023) [19]. TENS devices improve functional ability while reducing pain. Nevertheless, it was shown that applying TENS was a more efficient way to improve life quality.

In the group comparison analysis for the same variables in this study, there was a significant improvement observed in the TENS group when compared to the acupressure group. This improvement could be explained by the use of transcutaneous electrical nerve stimulation, or TENS, as a therapy option for both acute and chronic pain disorders. By triggering inhibitory mechanisms, TENS lowers central excitability, primarily in the central nervous system, and consequently pain. Through activating receptors such as opioid, GABA, serotonin, muscarinic, and cannabinoid receptors, TENS creates analgesia by stimulating the natural inhibitory pathways of the central nervous system. (Vance etal., 2022) [20].

According to (Peng etal.,2019) [21]. The analgesic effects of TENS vary and are mediated by several neurobiological pathways.

TENS raised salivary flow rate and dramatically decreased pain severity in hemodialysis patients experiencing access-related pain. TENS is a useful treatment for hemodialysis patients' access-related pain [3].

Prior research showing a significant decrease in pain supports this outcome. TENS produces segmental and extra segmental analgesia by applying pulsed electric currents to the skin's intact surface, stimulating the spinal cord and peripheral nerves [22].

Conclusion:

Both Acupressure and Transcutaneous Electrical Nerve Stimulation (TENS) are safe, noninvasive, and useful methods that can be combined with traditional physical therapy to lessen pain and enhance quality of life while undergoing dialysis; however, statistical analysis of previous studies and the current study indicates that TENS works better than acupressure.

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