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RESEARCH ARTICLE

TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION VERSUS NARROW BAND ULTRAVIOLET B ON PRURITUS IN HEMODIALYSIS PATIENTS

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ABSTRACT

Background: Itch (Latin pruritus) is been defined as unpleasant sensation that elicits the desire to scratch pruritus has been well recognized as a common and sometimes unbearable complication in patients who undergo hemodialysis uremia is well known as the most common cause of pruritus in chronic hemodialysis patients uremic pruritus has significant impact on mental and physical capacity of patients, contributing to day time fatigue, agitation, sleep disturbance and depression. Many metabolic factors have been implicated in the pathogenesis of itching in hemodialysis patients for examples, hypercalcemia, hyperphosphatemia, secondary hyper-parathyroidism and hypermagnesemia which considered one of causes of uremic pruritus which also includes: anemia, increase of mast cells in dermis of hemodialysis patients, xerosis and renal toxins. Transcutaneous electrical nerve stimulation (TENS) is an inexpensive form of analgesia that could also ameliorate itching, NB UVB phototherapy has efficacy in alleviating uremic pruritus with minimal adverse effect so both therapy consider safe for most of cases suffering from uremic pruritus. **Objective:** The purpose of this study was to compare the efficacy of TENS with that of NBUVB on pruritus hemodialysis patients. **Methods:** Thirty hemodialysis patients were randomly assigned into two group of equal number,15 patients for each group aged between 30-50 years old, all patients was assessed by physician carefully before starting of the study procedures, all patients had diagnosed with chronic renal failure stage 5, subjects of female was included, all patients was received the same physical care, medications and diet, area of maximum intensity of pruritus was back area and all participants was informed about the nature and the effect of the treatment and measurements device, the patients was instructed to reported any side effects during the treatment sessions. Group A (TENS group) received treatment with convetional TENS three times per weeks while group B (NBUVB group) received treatment with ultra violet B for , three times per weeks and duration of treatment session depended on erythema1 for each patient. Duration of treatment was two months for both groups. All groups received the same medical therapy (anti histaminic drugs, topical emollients) , assessment of patients was done pre and after 4,8 weeks of treatment For subjective measurements we used: The visual analogue scale (VAS) and 10 point pruritus questionaire. **Results**: there was statistically insignificant difference between both groups regarding mean value of VAS after 4,8 weeks of treatment (p-value 0.512 and 0.624 respectively), at the end of study 2 patients (13.3%) from each group showed complete responde to treatment, (53.3% of TENS group and 66.7% in NBUVB showed partial response) while (33.4% in TENS group and 20% in NBUVB were resistant to treatment. **Conclusion**: from the finding of this study there was no significant statistical difference between response to TENS or NBUVB after end duration of study which continued for 2 months. TENS and NBUVB therapy holds promise as a palliative, alternative, safe and inexpensive treatment for patients with chronic pruritic conditions.

INTRODUCTION

Chronic renal failure (CRF) is a major public health problem worldwide (Lupi O *et al*., 2011) (consider space between lupi and O please). It is defined as an abnormality in renal structure or function, with health implications present for at least 3 months. It is classified according to three variables: glomerular filtration rate (GFR), its etiology, and the amount of albuminuria. The three most common kidney diseases that lead to end-stage CRF are vascular nephropathy, obstructive nephropathy, and diabetic nephropathy. There are three types of hemodialysis: conventional hemodialysis, daily hemodialysis and nocturnal hemodialysis. Conventional hemodialysis: Chronic hemodialysis is usually done three times per week, for about 3–4 hours for each treatment, Daily hemodialysis is typically used by those patients who do their

own dialysis at home for two hours six days a week and The procedure of nocturnal hemodialysis performed three to six nights a week (National Kidney Foundation KDOQI guidelines, 2006). Pruritus (itching) is an unpleasant sensation that elicits the desire to scratch. It is a distressing symptom that can cause discomfort and threaten the effectiveness of the skin as a major protective barrier. Generalized pruritus is found in about 13% of all individuals with chronic renal disease and about 70% to 90% of those undergoing hemodialysis for its treatment (Mettang, 2014). Uremic pruritus potentially are disabling symptoms in patients with end stage renal disease that occurs independent of the cause of the end stage of renal disease (ESRD), , uremic pruritus is not related to the etiology of renal failure nor to age, gender, skin color, or time on dialysis and patients on both peritoneal and hemodialysis experience pruritus at similar rates (lara and makram,2011). Pruritus appeared within 2-3 months of start of dialysis in 75%. It occurred daily in 83%, weekly in 11%. It was intermittent in 45%, all day in 32%, and exacerbated at night in 23%. Areas of maximum intensity were legs (60%) and back (30%), 55% had sleep problems, 21% became agitated, while 11% became depressed. Dry skin and cold environment exacerbated while rest and hot environment ameliorated pruritus (Akhter *et al*., 2006).

Although the etiology of uremic itching seen in hemodialysis patients was not understood precisely, uremia itself; anemia; impairment of hemostasis of ions such as calcium, phosphorus, and magnesium; secondary hyperparathyroidism; inadequate dialysis; tools used during hemodialysis and sensitivity to the dialysate are among the factors implicated in the pathogenesis of itching (Mathur *et al*., 2010). This diversity in the etiology of uremic itching has increased the treatment options. Today, parathyroidectomy, diet, antihistamines, topical moisturizers, and erythropoietin are used in the treatment of uremic itching, as well as adequate, effective dialysis treatment and acupressure, aromatherapy, and phototherapy treatments (Ada S, 2005). A multidisciplinary approach is necessary to carry out the management of itching in this kind of patients (Tessari G., 2009).nurses have an important, primary responsibility in the treatment and follow-up of dialysis patients. Awareness of nurses about the factors that increase itching will help them to plan appropriate nursing activities to minimize the negative effects of itching on individuals and will enable them to provide training and consulting in this direction. Systemic therapies include thalidomide, opioid antagonists, phototherapy with narrow band UVB and experimental treatments with cutaneous field stimulation and vagal nerve stimulation considered methods used to treatment uremic pruritus. Transcutaneous electrical nerve stimulation (TENS) uses a pulsed electric current generated transcutaneously by a device, causing impulses to be carried along large-diameter afferent nerves. Subsequently, it produces presynaptic inhibition of nociceptive A delta and C fibers involved in the pain gates in the substantia gelatinosa and thus have an effect in pain control. Pain and pruritus are two sensations that share similarities both at the peripheral and central levels, and thus TENS could also provide antipruritic effect in itchy skin disorders So far, TENS has been reported to offer pruritus relief in generalized pruritus , prurigo nodularis, mycosis fungoides and burns (Greaves MW.,2005). NBUVB (280–315 nm) radiation is the most effective treatment for uremic pruritus (Robinson-Bostom L, 2000; Mazen S *et al*., 2008). The mechanism of action is speculative and is thought to be due to a "photoinactivation" of pruritogenic substances and histamine-releasing factors. Observational studies have suggested that narrow-band UVB (NB-UVB) phototherapy, either isolated or in combination with ultraviolet A (UVA) radiation, reduces pruritus caused by chronic kidney disease and alleviates itching in diseases such as psoriasis, atopic eczema, and cutaneous T-cell lymphoma (Rivard, 2005). So The aim of this study was to compare the efficacy of Transcutaneous electrical nerve stimulation versus narrow-band UVB on uremic prutitus in chronic hemodialysis patients.

MATERIALS AND METHODS

Trial design: Patients with chronic hemodialysis complaining from uremic pruritus participated in this randomized controlled trial (RCT) which took place from April 2018 to June 2018. Those patients were classified randomely into 2group of equal number,15 patients for each group all participants with aged ranged between (30-50) years old, all patients was assessed by physician carefully before starting of the study procedures, all patients had diagnosed with chronic renal failure, subjects of female was included, all patients was received the same physical care, medications and diet, area of maximum intensity of pruritus was back area and all participants was informed about the nature and the effect of the treatment and measurements device, the patients was instructed to report any side effects during the treatment sessions. Participants were randomly assigned into two equal groups (TENS group and NB-UVB group .Both groups received the same routine medical care (antihistamine drugs and topical emiollents with advices:use warm water rather than hot water to wash, use soft towel and gentle pat the skin dry, avoid exposure to irritant like perfumes deodorant, trim nails, eat healthy diet and avoid salt,spicey food, apply topical treatment gently in direction of hair growth, avoid humidity and use aircondition as must as possible).patients complain from uremic pruritus for at least four months and intensity ranged from mild to severe pruritus. Each group received physical therapy treatment for two months three times a week on back area. TENS group received a Conventional TENS with a high stimulation frequency (40-150 Hz) and low intensity, just above threshold of patient sensation, with the current set between 10-30 mA was used. The pulse duration was short (up to 50 microseconds) and duration of treatment session was about 30-40 minutes. While; Narrow-band UVB (NB-UVB) group received NB-UVB with wavelength (315nm_280nm) and energy per photon range from (3,94- 4,43 ev) therapy, duration of treatment session depended on erythema1 for each patient and irradiation dose was increased by 15% for each session.

Evaluation procedures were conducted before and at the 4^{th} week,8^{th} week post treatment the intensity of pruritus was assessed by visual analogue scale(VAS) and 10 points questionnaire scale: Patients were excluded if they had uncontrolled blood pressure, heart dysrrhythmia, patients with peace maker, recent myocardial infarction, cancere patients, patients with history of epilepsy, Open or irritated skin, Cognitive impairments, Impaired sensation and Skin cancer, or had a history of sun sensitivity.

Ethical consideration: The aim and protocol of the study were fully explained for each patient and a signed informed consent was obtained from each patient before participation in the study. This study was approved by the Ethical committee of the faculty of physical therapy. Cairo university and it is in accordance with the declaration of Helsinki.

Measurements and procedures were explained clearly to each patient. When the patients attends for treatment,they received full explanation to the purpose of the treatment,the therapeutic and physiological benefits of therapeutic devices.

Outcome measure: Visual analogue scale (VAS) and 10 points pruritus questioneire visual analogue scale (VAS) was considered as a method most common used for pruritus assessment, the patients assessed pruritus intensity using the horizontal and vertical VAS (100-mm line), it is show very good reproducibility. Based on detailed analysis following VAS categories were proposed: 0 = no pruritus, > 0-< 4 points = mild pruritus, ≥ 4 -< 7 points = moderate pruritus, ≥ 7-< 9 points = severe pruritus, and ≥ 9 points = very severe pruritus. In conclusion, the VAS was a valuable method of pruritus measurement (Reich *et al*., 2011) (reference without underline please). 10 point pruritus questioneire (Yosipovitch G *et al*., 2001) for assessment of pruritus including Personal data, Pruritus history, duration, appearance, Current antipruritic medications, Effect on sleep, effect of pruritus on daily activities and habits, Coping with pruritus, and quality-of-life measures and Severity of pruritus.

Therapeutic intervention

TENS procedure of application: For application of TENS in (group A): a Conventional TENS with a high stimulation frequency (40-150 Hz) and low intensity, just above threshold of patient sensation, with the current set between 10-30 mA will be used. The pulse duration is short (up to 50 microseconds) . patient was in prone lying position and four electrodes were applied on his back along vertebral column at level of scapula, lower back at level of lumbar region. The electrodes applied to the back of the patient, leaved them in place turning the stimulus on for approximately(30-40minute) patients were instructed to avoid vigorous tingling sensation. The onset of analgesia with this setup was virtually immediate. In individuals who respond well, analgesia persists for a variable time after the stimulation stops (Vladimir *et al*., 2011).

NB-UVB procedure of application: For application of NB-UVB in (group B) patient was in setting or standing positions with exposed back and distance from lamb to the patient equal approximately 30cm, ensuring that the rays was perpendicular to affected part .Selected group of patients was treated with narrow band ultra violet B for 2 months period, three times per weeks and duration of treatment depend on erythema1 for each patient and precautions was considered (Borzova *et al*., 2008).

STATISTICAL ANALYSIS: Descriptive analysis and unpaired t-test were coducted for comparison of subject characterestics between both groups. Paired t- test was used also to compared between before and after treatment mean values of VAS and 10-points questionaire in each group of individuals. A value of $P \leq 0.05$ was considered statistically significant for all statistical tests. Both of descriptive and analytical statistics was used to examine, describe, and analyze the collecting data in order to detect if there is inter group in intra group difference before and after the application of the treatment. All statistical tests were performed through the statistical package for social science(SPSS) version 19 for windows (IBM SPSS, Chicago, IL,USA) (Maronna *et al*., 2006) (rephrase word will be deleted please)

RESULTS

Overall, 30 patients (15 in each group) completed the duration of study for two months and the analysis of changes in VAS score reported as following: There was no statistically significant difference between both groups therapy regarding mean value of VAS after 4,8 weeks of treatment (p-value 0.512 and 0.624 respectively) ,at the end of study 2 patients(13.3%) from each group showed complete responder to treatment,(53.3% of TENS group and 66.7% in NBUVB showed partial response)while (33.4% in TENS group and 20% in NBUVB were resistant to treatment).there was no statistically significant difference between both groups regarding mean value of VAS pre treatment (P-value 0.683). The mean value of VAS pre treatment ± SD in TENS group was 6.6±1.056 while that of NBUVB was 6.8±1.265 with mean difference 0.2. there was no statistical significant difference between both groups regarding mean value of VAS 4 week's treatment (P-value 0.512). The mean value of VAS post 4 weeks treatment ± SD in TENS group was 5.13±1.302 while that of NBUVB was 4.8±1.612 with mean difference 0.33. there was no statistically significant difference between both groups regarding mean value of VAS 8 week's treatment (P-value 0.512). The mean value of VAS post 8 weeks treatment ± SD in TENS group was 3.866±1.302 while that of NBUVB was 3.866±1.302 with mean difference 0.399.

DISCUSSION

Chronic kidney disease (CKD) is an increasing global burden regarding social, epidemiological and economic aspects. the burden is greater in the developing contouries be caused of limited resources and poverty. In Egypt the problem is increasing and it represents one of the major health problems. the development of a palliative, safe therapy for pruritus in chronic hem dialysis is a research priority in our country. this study disscuss effect of TENS, NBUVB on uremic pruritus in hem dialysis after 4 and 8 weeks of treatment and compare the results in between. This study suggests that TENS and NBUVB might offer a supportive relieving tool for uremic pruritus patients.It should be noted that TENS efficacy for pain relief has been well established but the exact mechanism is unclear. Some possible explanations have been proposed such as neuromodulation via presynaptic inhibition in the dorsal horn of the spinal cord (gate control theory), endogenous pain control (via endorphins, enkephalins, and dynorphins), direct inhibition of an abnormally excited nerve, and restoration of afferent input. TENS could theoretically provide antipruritic effect in itchy skin disorders (DeSantana *et al*., 2008). the mean value of VAS pretreatment ± SD regarding TENS group was 6.6±1.056 and decreased to 5.133± 1.302 four weeks after treatment to become 3.866±1.125 eight weeks after treatment, the percent of change was 41.42%. This reduction in mean VAS value was significant statistically (P-value <0.001). The results of this study revealed significant decreasing of VAS in TENS group that agreement with (Savk E *et al*., 2007, Ali *et al*., 2015, Tarng et., 1996, Waked I *et al*., 2018 and Michael J *et al*.,2019). Phototherapy is the use of UV radiation in the treatment of skin disease. Radiation within the UV spectrum can be divided by wavelength into UVC (200–280 nm), UVB (280–320 nm) and UVA (320–400 nm). Ultraviolet (UV) A and UVB (medium wave) phototherapy has been reported to decrease the release of histamine from either mast cells and/or basophils. Previous small studies have suggested that UVB phototherapy is a good alternative treatment for uremic

pruritus (Aydogan *et al*., 2012). NB-UVB (280–315 nm) radiation is the most effective treatment for uremic pruritus (Robinson-Bostom L, 2000; Mazen S *et al*., 2008). The mechanism of action is speculative and is thought to be due to a "photoinactivation" of pruritogenic substances and histamine-releasing factors the mean value of VAS pretreatment ± SD regarding NBUVB group was 6.67±1.234 and decreased to 4.53±1.552 four weeks after treatment to become 3.2±1.74 eight weeks after treatment, the percent of change was 52.024%. This reduction in mean VAS value was significant statistically (P-value <0.001). The results of this study revealed significant decreasing of VAS in narrow band ultraviolet therapy group that agreement with (Ada S *et al*., 2005, Seckin D., 2007, Franz J., 2018 and Kidney International Supplements 2013).

Conclusion

From the finding of this study there was no significant difference between response to TENS or NBUVB after end duration of study which continued for 2 months. TENS and NBUVB therapy holds promise as a palliative, simple, tolerable, alternative, safe and inexpensive treatment for patients with chronic pruritic conditions and resulted in improvement of uremic pruritus in hemodialysis patients and so decrease severity, frequency of itching and improve sleep disturbance, mood, appetite, quality of life and activities of daily living.

Recommendation

According to results of this study, the following recommendations may be suggested: more extensive studies assessing the efficacy of convetional TENS and NBUVB in treatment of uremic pruritus in hemodialysis patients are needed, Similar studies should be conducted using a large number of patients providing better statistical treatment of data, follow-up studies of various treatment duration would be of great interest, further investigations by using more and different instrumentations, Based on the results of the current study, larger scale studies are recommended to assess the therapeutic effect of TENS and NBUVB on pruritus associated with hemodialysis and to detect its impact on patient's quality of life, further researches should be extended for a longer period than 2 months and further researches could include a comparison between another physical therapy modalities and protocols.

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