

Multimodal Education Package and Hyperbaric Oxygen Therapy for Diabetic Foot Ulcers: Patients` Needs Management

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Abstract: *Aim:* This study aimed to evaluate the effect of multimodal education package about hyperbaric oxygen therapy for diabetic foot ulcers on patients` needs management .

Subjects and Method : A quasi-experimental design was utilized for the conduction of this study in the Hyperbaric Oxygen Therapy (HBOT) Unit and Surgical Outpatients` Clinics affiliated to Nasser Institute Hospital . A purposive **sample** composed of 80 adult patients from both genders with diabetic foot ulcers (neuropathic and ischemic) from the above mentioned settings .

Tools: 1) Patients' needs assessment sheet (pre / post and follow up tests) to assess studied patients' health needs (physical , psychological , social , spiritual and educational) , 2) Wound symptoms assessment sheet (pre / post and follow - up tests) to assess wound condition . 3) Powerlessness Assessment Tool (pre / post and follow- up tests) to measure level of powerlessness . **Results:** More than two fifths of studied patients were male , had the age of 40 - less than 50 yrs and with underweight . Moreover , their health needs were higher in pre test , added to elevated anxiety concerns , pain levels and poor wound condition . **Conclusion :** The multimodal education package had a positive effect on management of health needs (physical, social, psychological, spiritual and educational) among the studied patients undergoing HBOT in conjunction to standard treatment . Moreover , significant improvement in wound symptoms and level of powerlessness was indicated post treatment that possibly attributable to better ulcers healing . **Recommendations:** Further studies should be carried out on a large number of such group of patients for evidence of the results and generalization .

Keywords: Hyperbaric Oxygen Therapy - Patients` Needs - Multimodal education package

Date of Submission: 21-02-2019

Date of acceptance:08-03-2019

I. Introduction

Diabetic foot ulcers has gradually become a hot topic for non-traumatic amputation and bad treatment effect but with huge cost of diabetic foot seems so eclipse . It result from a combination of neuropathy, trauma and foot deformities. Many patients have concomitant peripheral arterial occlusive disease (PAOD) which is a prognostic factor . Ischemic diabetic ulcers are notoriously difficult to treat and require complex and costly multimodal treatment consisting of pressure off-loading, optimizing glycemic control , revascularization and local wound treatment ^(1,2) .

The world never lacks solutions to problems, even though some methods may be controversial such as the treatment of hyperbaric oxygen (HBOT) for diabetic foot . It involves intermittent administration of 100% oxygen inhaled at a pressure greater than sea level , may be given in multi-place chamber (used to treat multiple patients at the same time) and monoplace chamber (used to treat a single patient) . Typically, it is given 5-6 days a week for at least 20 treatments and must be used in conjunction with normal wound care treatment ^(3,4) .

Inhalation of pure oxygen at higher pressure causes plasma and hemoglobin to become supersaturated, so increase oxygen delivery to all tissues and drives oxygen directly through skin rising oxygen level in all tissues . A typical session lasts between 60 and 90 minutes and not more than 120 minutes . Prescribed pressure and time will be determined by type of pathogen at wound site and other factors such as revascularization degree around the affected tissues . Each session consists of three phase: compression (takes between 6-10 minutes and sometimes 30 minutes to raise pressure inside the chamber) and decompression (decreased pressure to normal, takes between 6-10 minutes but can last as long as 30 minutes)^(5,6). Hypoxia in wounds and responsiveness to oxygen are determined from transcutaneous oximetry monitoring (Tcpo2 = 30 mm Hg) at the

affected distal lower extremity . HBOT is used with pressures of 2.0 to 3.0 atmospheres absolute, and partial pressures of arterial oxygen (Pao₂) of 1,200 mm Hg can be attained . Benefits of HBOT in wound healing include : enhance periwound tissue oxygenation, oxidative killing of bacteria, cellular energy production, antibiotic potentiation , neoangiogenesis promotion , epithelial migration , collagen production and granulation-tissue formation . The effects of cytokines, prostaglandins and nitric oxide on tissues also may play a major role in how HBOT works. Some literature suggests HBOT mobilizes stem cells derived from bone through a nitric oxide-mediated pathway; these stem cells then migrate to the ulcer and promote healing ^(7,8) .

Contraindications of HBOT are few absolute and several relative . **Absolute** include untreated pneumothorax and use of bleomycin, disulfiram, doxorubicin and mafenide acetate . Contraindicated drugs must be discontinued before HBOT . **Relative** call for caution but don't prohibit HBOT. It include seizure disorders, emphysema with carbon dioxide retention, high fever, history of spontaneous pneumothorax, optic neuritis, upper respiratory infection, pregnancy, congenital spherocytosis, implanted pacemakers or epidural pain pumps , chemotherapy agent doxorubicin (Adriamycin) that thought to become cardiotoxic when used concurrently with HBOT^(9,10) . Adverse effects of HBOT include : ear barotraumas , sinus squeeze, tooth squeeze if the patient has an air space under a filling, transient myopia, claustrophobia, oxygen toxicity and rarely seizures . Moreover , hypoglycemic effect during treatment ^(11,12) . Multimodal education package consists of patients` instructions, educational pamphlet and film , orientation round in the BMT Unit that could be effective in improving health ` condition . Patients` education and appropriate preparation would positively affect health promotion , awareness , attitudes, skills and behaviors . Education can reduce patients` anxiety, increase coping with health condition and decrease length of hospital stay^(13,14) .

The needs were defined as 'the requirements of individuals to enable them to achieve, maintain or restore an acceptable level of social independence or quality of life . Health is defined as a "state of complete physical, mental and social wellbeing not merely absence of the disease or infirmity". The needs include physical , psychological, social, spiritual, and educational aspects ^(15,16) . DFU has been found to impact quality of life (QoL) in various dimensions: physically, mentally, socially, and economically . It can result in pain , insomnia , fatigue , limited mobility, social isolation , loneliness, restricted life, loss of control , fear for the future and deficit in activities of daily living which has been reported to adversely affect ^(17,18) .

Significance of the Study:

Diabetic foot ulcer (DFU) represent a major source of morbidity and mortality in patients diagnosed with diabetes mellitus in developing countries. Patients have 3–11% annual risk of developing lower-extremity ulcers and every year, 1.9% of them develop foot ulcers and 15% - 20% undergo an amputation within 5 years of ulcer onset . Studies have shown that annual population-based incidence may range between 1% - 4.1% and prevalence from 4% - 10%. In Nigeria, its` prevalence is increased with rate between 11.7% - 19.1% ^(19,20)

In Egypt according to statistical record, the incidence of hyperbaric oxygen therapy for diabetic foot ulcers in Nasser institute Hospital during the period of 2016 to 2017 were approximately 200 patients . Multimodal education package can help them to self-care , prevent complications, carry out prescribed therapy and solve problems .

Aim of the study:

This study aimed to evaluate the effect of multimodal education package about hyperbaric oxygen therapy for diabetic foot ulcers on patients` needs management . This aim was achieved as follows:

- Identify studied patients health needs (physical, psychological , social spiritual and educational) .
- Assess condition of the wound and level of powerlessness
- Develop and implement the multimodal education package for the studied patients and evaluate its effect on their health needs management , wound condition and powerlessness level .

Hypothesis:

It was hypothesized that , the multimodal education package about hyperbaric oxygen therapy for diabetic foot ulcers have a positive effect on patients` needs management .

II. Subjects and Methods

Operational definitions:

Patient's health needs : means physical, psychological, social, spiritual and educational .

Undergoing HOT sessions : means pre / during and post treatment session

Multimodal education package : means individualized face-to-face patient education, provision of an educational pamphlet, presenting a video, and performing a round in the bone marrow transplantation unit .

Powerlessness : defined as perception that own action would not significantly affect a result , lack of control perceived about a current situation or an immediate happening .

Research design:

A quasi-experimental design was utilized to conduct this study

Setting:

The study was carried out at the HBOT Unit and Surgical Outpatients` Clinics affiliated to Nasser Institute Hospital.

Subjects:

A purposive sample of (80) adult patients from both genders with diabetic foot ulcers (neuropathic and ischemic) from the above mentioned settings . They were selected according to the sensitive analysis in relation to the number of patients with diabetic foot ulcers within the year 2017 in Naser Institute Hospital , according to the statistical department which affiliated to the setting with the following criteria:

Inclusion criteria :

- Patients with diabetic foot ulcers wound (neuropathic and ischemic) that fail to respond to optimal conventional medical and surgical treatment in a reasonable time frame
- Patients received traditional wound care
- Patients did not receive previous HBOT
- Patients with no co-morbid conditions
- Conscious adult patients
- Patients agree to participate in the study and complete the treatment sessions .
- Blood glucose test within normal level
- Time scheduled of each HBOT session from 60-90 minutes, with 100% oxygen for respiration at pressure greater than 1 atmosphere absolute (ATA)
- Patients will be taken pre /during / post and in follow – up period of treatment (from first follow up visit up to two months).

Tools of data collection:

Tool I:

Patients' needs assessment sheet (pre / post and follow up tests) . It was designed by the researchers after reviewing the related literature and consulting the experts to assess studied patients' health needs about HOT for diabetic foot ulcers . It was written in simple Arabic language and divided into the following parts :

- **Characteristics of the studied patients** such as : age, gender, marital status, income, educational level , smoking and wound types.
- **Patients' medical records** to identify past, present medical and surgical history, diagnosis, diagnostic measures and management
- **Patients` needs included :**
 - 1- Physical needs** such as (Compliance with prescribed drugs , perform daily living activities , control of blood sugar level and vital signs , relieve of pain , assist in movement / transportation , coping with bandages compressor problems , control wound infection , manage sleep disturbances , compliance with therapeutic diet and regular follow – up visits) . The following scale was assist :

Numerical pain scale : It was based on Jacques (2011) to measure pain severity and formed of a line divided by numbered points from (0-10) . Patients' answers were sorted as follows : no (zero), mild (0 - less than 4), moderate (4-less than 7) and severe (7 - 10).

2-Psychological needs such as : Positive adjustment with health condition , improve of knowledge , relieve anxiety, fear and guilt feeling , manage unpleasant wound odor , relieve fear from complications , positive body image and improve of self-respect/self-esteem . The following tool was assist :

Patients' anxiety concerns assessment sheet : It was developed by the researchers in light of the relevant and related literatures (Dewit et al., , 2016 & Lewis et al. , 2014) to evaluate patients concerns as regards : Lack of medical / nursing supervision , pain severity , physical injuries , restrictions due to dressing changes / cosmetic effect of dressing , lack of information , social isolation , prognosis and loss of self control.

3-Social needs such as : Increase social support , relieve family burden , assistance for handicap /independent , coping with changes in work nature , improve information about sexuality and increase of recreational activities .

4-Spiritual needs such as : Decrease hopelessness on recovery , increase satisfaction , manage changes in routine religious , positive goal in life and relieve feeling of sadness .

5-Educational needs such as : Increase awareness with HBOT as regards : definition / Indications, complications , contraindications , safety measures , physical preparations (pre, during and post) treatment sessions , treatment guidelines , wound management , therapeutic diet , infection control measures and activities of daily living .

Scoring system of patients` needs :

Patients' responses regarding the presence of health needs (scored as two marks) or absence (scored as one mark), were categorized into either yes or no. Total items of health needs = 41 items , whereas needs absence were considered from less than 50% and needs presence from 50% & more

Tools II :

Wound symptoms assessment sheet (pre / post and follow-up tests) : It was adapted from **Naylor & Grey (2006)⁽²³⁾** to assess wound condition for the studied patients in relation to the following :

- Pain with dressing
- Exudates
- Bleeding
- Wound smell
- Itching and
- Pain from wound

Tools III :

Powerlessness Assessment Tool (PAT) (pre / post and follow-up tests) : It was based on **Almeida et al. (2014)⁽²⁴⁾** to measure level of powerlessness among studied patients . It was formed of 12 items were grouped into three domains : Capacity to perform behavior , self – perception of decision- making capacity and emotional responses to perceived control .

Scoring system :

Answers were scored as positive (1) or negative (zero) and total score ranged from 0-12 . The following categorization were adapted : absent (0) , mild (1 - < 4), moderate (4- < 8) and sever (8 - 12) . The higher scores corresponding to stronger feelings of powerlessness .

Content validity:

It was ascertained by a group of experts including experts from Hyperbaric Oxygen Therapy Unit , General Surgery and Medical Surgical Nursing staff . Their opinions were elicited regarding to the tool format layout, consistency and scoring system . The content tools were tested regarding to the knowledge accuracy, relevance and competence .

Ethical considerations:

In the planning stage approval was obtained from Directors of the above mentioned settings . All patients were informed about the study and their rights according to medical research ethics to decide free whether or not they would participate in the study. Then a written informed consent was obtained from each patient who agreed to participate in the study.

Pilot study:

A pilot trial was carried out on 10% of the total sample to test practicability and clarity of study tools, added to sample and settings . Pilot sample was later involved in the study as there were no radical modifications in the study tools.

Procedures:

- Sampling was started and completed within 10 months.
- Purpose of the study was explained to the patients who agreed to participate in the study prior to any data collection.
- Number of treatment sessions and pressure level were determined by the physician. Treatment course = 30 sessions which were classified as follow: one session daily for 6 days/week.
- The treatment course may be repeated according to patients` wound healing assessment.
- The researchers starts to collect data from the patients 2 days/ week on the same day of scheduling for the treatment sessions using the pre-constructed tools in Outpatients` Clinics of HBOT Unite .

- The education package was designed based on analysis of actual patients' needs assessment through the pre constructed tools . It was consistent with the related literatures (national and international) , included theoretical and practical sessions .
- Patients were divided into small groups including 4 – 5 and each group obtained 4 sessions (2 theory and 2 practice). At first simple written instructions were distributed with orientation about the objectives and outlines .
- The theoretical part was implemented through face-to-face patients` education with lectures and group discussions using data show and poster as a media . In addition to provision of an educational booklet , It was taken in 2 sessions (each session for 45 minutes) . During theoretical sessions HBOT was explained to patients added to an educational pamphlet about the procedure which included : HBOT definition , indications, complications, contraindication , guidelines pre , during and post treatment sessions , drugs order pre sessions, interaction between drugs and HBOT , wound symptoms , safety measures , physical preparations , pain management , wound care, dietary regimen and physical activities . In addition , pictures of different parts of HBOT Unit and a 10-minute video describing the environment , treatment sessions and pre /during / post care . As well as experiences of another patients with the same procedure was shown to studied patients . Lastly , researchers answered for any questions .
- The practical part was implemented through demonstration, re- demonstration , video and performing a round in HBOT Unit . It was taken in 2 sessions (each session for one hour) and covered the following items : The first session included wound care and infection control measures . Second session included daily activities , ambulation , breathing and leg exercises .
- Patients were informed to be in contact with the researchers by telephone for any question .
- Wound condition weekly assessed by physician in HBOT Unite .
- Traditional dressing was made in the Surgical Outpatients` Clinics according to physician order.
- Patients were assessed either individually or in groups that entail 4-5 according to their physical and mental readiness.
- Evaluation for the following :
 - Effect of multimodal education package on the studied patients` needs using the pre constructed tools as follows :
 - Post test was done after one month from the educational guidelines and follow - up test after two months later by using the same tools
 - Patients` wound condition and powerlessness assessment as follows :
 - Post test was done after one month from the first treatment session and follow - up test after two months later by using the same tools

III. Results

Table (1) : Shows characteristics of the studied patients . As indicated more than two fifths of them were male , had the age of 40 - less than 50 yrs and with underweight (48.7 , 46.2 & 46.2 respectively) . Concerning income , residence , job and wound type , more than half of them had enough income , were from urban area , working and with neuropathic wound (70.0 , 57.5 , 56.3 & 40.0 respectively) . In relation to education , more than one third of them had high level .

Table (2) : Shows physical needs among the studied patients` in pre/post tests . A statistically significant difference was indicated between pre/post tests as regards the physical needs . More improvement was observed in post test compared to pre (mean = **24.2 ±11.1** & **53.0 ± 16.8** respectively) with $t= 12.8$, $p < 0.05$. In addition , significant difference was noticed in follow up test compared to post (mean = **7.2 ± 2.3** & **24.2 ±11.1** respectively) with $t= 13.1$, $p < 0.05$.

Table (3) : Reveals psychological needs among the studied patients in pre/post tests . A statistically significant difference was observed between pre/post tests as regards the psychological needs . More improvement was indicated in post test compared to pre (mean = 26.0 ± 6.7 & 60.0 ± 10.9 respectively) with $t= 24.3$, $p < 0.05$. In addition , significant difference was noticed in follow up test compared to post (mean = 9.8 ± 2.0 & 26.0 ± 6.7 respectively) with $t= 20.1$, $p < 0.05$.

Table (4) : Reports social needs among the studied patients in pre/post tests . A statistically significant difference was noticed between pre/post tests as regards the social needs . More improvement was indicated in post test compared to pre (mean = 27.0 ± 6.4 & 55.5 ± 7.2 respectively) with $t= 26.6$

, $p < 0.05$. In addition , significant difference was noticed in follow up test compared to post (mean = 12.2 ± 4.4 & 27.0 ± 6.4 respectively) with $t = 17.2$, $p < 0.05$.

Table (5) : Clarifies spiritual needs among the studied patients in pre/post tests . A statistically significant difference was indicated between pre/post tests as regards the spiritual needs . More improvement was found in post test compared to pre (mean = 29.2 ± 6.1 & 36.8 ± 7.5 respectively) with $t = 7.03$, $p < 0.05$. In addition , significant difference was noticed in follow up test compared to post (mean = 11.0 ± 1.6 & 29.2 ± 6.1 respectively) with $t = 26$, $p < 0.05$.

Table (6) : Shows educational needs among the studied patients in pre/post tests . A statistically significant difference was observed between pre/post tests as regards the educational needs . More improvement was found in post test compared to pre (mean = 30.2 ± 4.7 & 64.9 ± 5.3 respectively) with $t = 43.4$, $p < 0.05$. In addition , significant difference was indicated in follow up test compared to post (mean = 10.7 ± 2.2 & 30.2 ± 4.7 respectively) with $t = 32.5$, $p < 0.05$.

Figure (1): Reveals studied patients` anxiety concerns and pain level in pre/post tests . Concerning anxiety , more improvement was found in post and follow – up tests compared to pre (25.3 , 11.3 & 48.8 respectively) .As regards pain level , more than two thirds of them had severe pain in pre test compared to post and follow – up tests (71.0 , 28.0 & 6.0 respectively) .

Table (7): Shows wound symptoms assessment among studied patients pre/post treatment sessions . As noticed, more improvement was found in post and follow – up tests compared to pre (mean = 33.0 ± 3.7 , 8.8 ± 1.5 & 71.3 ± 4.9 respectively) with $t = 55.0$ & 54.7 , $p < 0.05$.

Table (8): Reveals studied patients` powerlessness level in pre/post tests . As noticed, more improvement was found in post and follow – up tests compared to pre as regards the following : Patients` capacity to perform behavior (mean = 43.0 ± 9.0 , 64.8 ± 5.1 & 21.8 ± 6.1 respectively) . Patients` self - perception of decision-making capacity (mean = 33.0 ± 2.0 , 14.0 ± 2.0 & 59.0 ± 3.6 respectively) . Patients` emotional responses to perceived control (mean = 32.3 ± 3.0 , 12.3 ± 2.5 & 68.3 ± 4.5 respectively) .

Table (1): Characteristics of the studied patients (n = 80)

Items	Studied Patients (n=80)	
	No	%
Age (years)		
< 40	7	8.8
40 - < 50	37	46.2
50 & more	36	45.0
Mean No ± SD	26.7 ± 17.0	
Educational level		
High	30	37.5
Moderate	26	32.5
Low	24	30.0
Sex		
Male	39	48.7
Female	41	51.3
BMI		
Over weight (less than 18.5)	28	35.0
Normal weight (18.5 – 25)	15	18.8
Under weight (more than 25)	37	46.2
Residence		
Urban	46	57.5
Rural	34	42.5
Job		
Working	45	56.3
Not working	35	43.7
Income		
Enough	56	70.0
Not enough	24	30.0
Wound type		
Neuropathic	32	40.0
Ischemic	48	60.0

Table (2): Distribution of physical needs among the studied patients` in pre/post tests (n=80)

Physical needs	Studied Patients (n=80)		
	Pre	Post	Follow- up
	No	No	No
Compliance with prescribed drugs	66	22	8
Perform daily living activities	61	38	10
Keep of blood sugar level / vital signs	42	15	5
Relieve of pain	73	42	6
Assist in movement / transportation	62	31	9
Coping with bandages compressor problems	60	32	11
Control wound infection	66	22	8
Manage sleep disturbances	39	17	6
Compliance with therapeutic diet	42	15	5
Regular follow – up visits	19	8	4
Mean No ± SD	53.0 ± 16.8	24.2 ± 11.1	7.2 ± 2.3
% of Mean	66.3%	30.3%	9.0%
T – value	T1 between pre & post tests = 12.8*		
	T2 between post & follow- up tests = 13.1*		

*Significant at p < 0.05

Table (3): Distribution of psychological needs among the studied patients in pre/post tests (n=80)

Psychological needs	Studied Patients (n=80)		
	Pre	Post	Follow- up
	No	No	No
Positive adjustment with health condition	68	24	11
Improve of knowledge	61	21	9
Relieve anxiety, fear and guilt feeling	69	32	11
Manage unpleasant wound odor	57	24	7
Relieve fear from complications	39	19	8
Positive body image	70	38	13
Improve of self-respect/self-esteem	56	24	10
Mean No ± SD	60.0 ± 10.9	26.0 ± 6.7	9.8 ± 2.0
% of Mean	75.0%	32.5%	12.3%
T – value	T1 between pre & post tests = 24.3*		
	T2 between post & follow- up tests = 20.1*		

Table (4): Distribution of social needs among the studied patients` in pre/post tests (n=80)

Social needs	Studied Patients (n=80)		
	Pre	Post	Follow- up
	No	No	No
Increase social support	63	30	13
Relieve family burden	52	32	10
Assistance for handicap /independent	56	29	12
Coping with changes in work nature	64	33	19
Improve information about sexuality	53	20	9
Increase of recreational activities	45	18	7
Mean No ± SD	55.5 ± 7.2	27.0 ± 6.4	12.2 ± 4.4
% of Mean	69.4%	33.8%	15.3%
T – value	T1 between pre & post tests = 26.6*		
	T2 between post & follow- up tests = 17.2*		

Table (5): Distribution of spiritual needs among the studied patients` in pre/post tests (n=80)

Spiritual needs	Studied Patients (n=80)		
	Pre	Post	Follow- up
	No	No	No
Decrease hopelessness on recovery	62	23	10
Increase satisfaction	67	35	13
Manage changes in routine religious	54	28	9
Positive goal in life	47	24	12
Relieve feeling of sadness	64	36	11
Mean No ± SD	36.8 ± 7.5	29.2 ± 6.1	11.0 ± 1.6
% of Mean	46.0%	36.5%	13.8%
T – value	T1 between pre & post tests = 7.03 *		
	T2 between post & follow- up tests = 26*		

Table (6): Distribution of educational needs among the studied patients` in pre/post tests (n=80)

Educational needs	Studied Patients (n=80)		
	Pre	Post	Follow-up
	No	No	No
Definition / Indications of HOT	70	25	8
Complications / Contraindications of HOT	54	30	11
Safety measures of HOT	67	24	8
Physical preparation pre treatment session (pre, during & post)	72	36	13
Treatment guidelines	65	33	11
Wound management	62	28	10
Therapeutic diet	61	30	14
Infection control measures	67	36	8
Activities of daily living	62	25	12
Mean No ± SD	64.9 ± 5.3	30.2 ± 4.7	10.7 ± 2.2
% of Mean	81.1%	37.8%	13.4%
T – value	T1 between pre & post tests = 43.4 * T2 between post & follow-up tests = 32.5*		

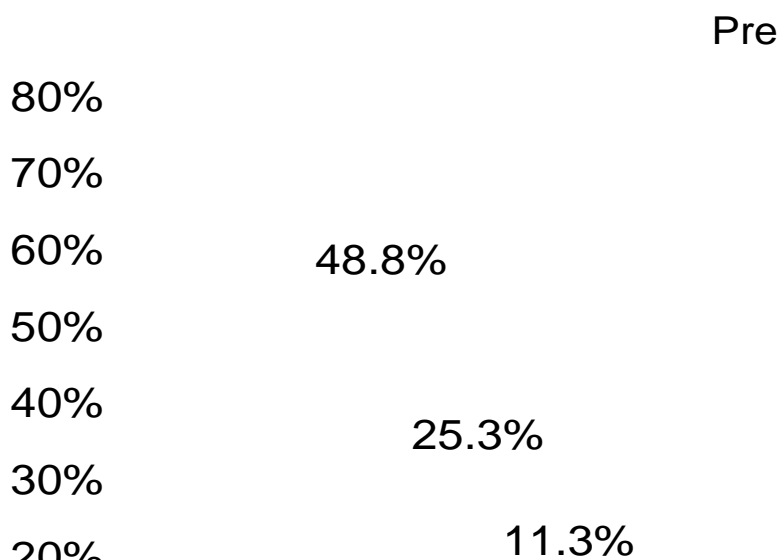


Figure (1): Distribution of anxiety concerns and pain level among studied patients in pre/post tests (n= 80)

Table (7): Distribution of wound symptoms assessment among studied patients pre/post treatment sessions (n= 80)

Items	Studied Patients (n=80)		
	Pre	Post	Follow – Up
	No	No	No
Pain with dressing	76	38	9
Exudates	69	36	11
Bleeding	71	31	8
Wound smell	73	34	7
Itching	63	28	8
Pain from wound	76	31	10
X̄ No ± SD	71.3±4.9	33.0 ±3.7	8.8 ±1.5
% of Mean	89.1%	41.2%	11.0%
T – value	T1 between pre & post tests = 54.7 * T2 between post & follow-up tests = 55.0 *		

Table (8): Distribution of powerlessness level among studied patients in pre/post tests (n= 80)

Items	Studied Patients (n=80)		
	Pre	Post	Follow – Up
	\bar{X} No \pm SD	\bar{X} No \pm SD	\bar{X} No \pm SD
Patients`capacity to perform behavior :	21.8 \pm 6.1	43.0 \pm 9.0	64.8 \pm 5.1
Patients` self - perception of decision-making capacity :	59.0 \pm 3.6	33.0 \pm 2.0	14.0 \pm 2.0
Patients` emotional responses to perceived control :	68.3 \pm 4.5	32.3 \pm 3.0	12.3 \pm 2.5
Level of powerlessness (%)			
Mild	7.0	36.0	58.0
Moderate	22.0	43.0	26.0
Severe	71.0	21.0	16.0

IV. Discussion

Diabetic foot ulcers (DFUs) are estimated to affect 15% of people with diabetes during their lifetime . Hyperbaric oxygen therapy (HBOT) is defined as a noninvasive alternative method for the treatment of diabetic foot ulcers because it accelerate wound healing and reduce amputation . Patients with HBOT are affected physiologically, psychologically and socially by the negative way so it is important to meet their needs for improving the quality of life ^(2,25) . The present study aimed to evaluate the effect of multimodal education package about hyperbaric oxygen therapy for diabetic foot ulcers on patients` needs management .

Considering studied patients` age and gender . Results indicated that more than two fifths of them were male , had the age of 40 - less than 50 yrs and with underweight . **Mutluoglu et al. (2016), Abdullah et al. (2017) &** ^(12,26) reported that, ageing changes place patients at higher risk of poor wound healing as: reduced skin elasticity and collagen replacement, declines of the immune system making the patients more susceptible to infection .

As regards income , residence , job and wound type among the studied patients . Results revealed that more than half of them had enough income , were from urban area , working and with neuropathic wound . **Alzahrani et al. (2012) & Ahmed et al. (2011)** ^(27,28) stated that geographic location influence on patients` behavior and enough income may be interpreted as Ministry of Health give treatment decisions for patients without work because the employed patients had health insurance . On the same lien, HBOT in the treatment of diabetic foot ulcers was cost effective adjunct to standard wound care particularly on a long term basis . Moreover , ischemic wound healing had the higher percent of improvement than neuropathic wound .

Concerning physical needs among the studied patients , results revealed significant difference between pre / post tests , whereas more improvement was observed in post test as regards : compliance with prescribed drugs , perform daily living activities , control of blood sugar level and vital signs , relieve of pain , assist in movement / transportation , coping with bandages compressor problems , control wound infection , manage sleep disturbances , compliance with therapeutic diet and regular follow – up visits . The previous findings were interpreted as patients` information were obtained from physician and nurses . **Cheung et al. (2016) and Abduekarem & El-shareif (2013)** ^(8,29) stated that three fifths of patients had physical complaints for investigations , follow-up and emergency condition .

Regarding psychological needs among the studied patients , results revealed significant difference between pre / post tests , whereas more improvement was observed in post test as regards : positive adjustment with health condition , improve of knowledge , relieve anxiety, fear and guilt feeling , manage unpleasant wound odor , relieve fear from complications , positive body image and improve of self-respect and self-esteem . The previous findings were interpreted as the physician , nurse and family should have a positive role to meet such psychological needs . **Linton & Maebius (2015)** ⁽³⁰⁾ reported that patients with HBOT procedure were worried from the treatment sessions complications .

In relation to social needs among studied patients . Results revealed significant difference between pre / post tests , whereas more improvement was observed in post test as regards : Increase social support , relieve family burden , assistance for handicap /independent , coping with changes in work nature , improve information about sexuality and increase of recreational activities . **Cho et al. (2018) & Dewit et al. (2016)** ^(9,22) stated that patients with HBOT had home and work changes as a result of the disease . Moreover , some patients were change or leave their job post disease onset that affect their income .

As regards spiritual needs among studied patients . Results revealed significant difference between pre / post tests whereas more improvement was observed in post test as regards : decrease hopelessness on recovery , increase satisfaction , manage changes in routine religious , positive

goal in life and relieve feeling of sadness. **Kranke et al. (2015)**⁽⁶⁾ mentioned that more than half of study subjects were satisfied and had positive vision for the future post HBOT sessions .

Considering educational needs among studied patients . Results revealed significant difference between pre / post tests whereas more improvement was observed in post test as regards : Increase awareness with HBOT for definition / Indications, complications , contraindications , safety measures , physical preparations (pre, during and post) treatment sessions , treatment guidelines , wound management , therapeutic diet , infection control measures and activities of daily living . The previous findings were interpreted as the physician and nurse should have a positive role to meet such educational needs . In addition , majority of patients did not have enough information about HBOT therefore they should be provided with more interpretations pre treatment sessions . **Pougnat et al. (2018) and Taylor & Lemone (2013)**^(5,31) reported that patients need for more knowledge about HBOT such as side effect relief , follow- up visits , medications , daily activities , wound care , hygienic measures and working .

As regards level of pain assessment among studied patients . Results revealed that more than two thirds of them had severe pain in pre test compared to post . This findings may be related to lack of psychological preparation , fear from procedural complications , added to disease manifestations for pain . **Grefl et al. (2017) & Game et al. (2016)**^(7,17) stressed on the value of medications administration plus the HBOT to help on pain relieve . Moreover , the experience of DFU-related pain can be overwhelming, impacting on patients' QoL and may be triggered/ worsened by dressing change procedure that is essential to facilitate ulcer healing .

In relation to studied patients` anxiety concerns . Results revealed significant difference between pre / post tests whereas more improvement was observed in post test as regards : lack of medical / nursing supervision , pain severity , physical injuries , restrictions due to dressing changes / cosmetic effect of dressing , lack of information , social isolation , prognosis and loss of self control . **Zhao et al. (2017) & El Saay et al. (2016)**^(1,32) discussed that, anxiety activates sympathetic nervous system which characterized by an increase in catecholamine concentration, heart rate, blood pressure and glucocorticoid levels. It also affects immune responses, therefore, there is a need for nursing intervention to reduce patients` anxiety . Moreover , teaching patients represent an important role in the treatment and contributes to decrease anxiety level⁽¹⁵⁾ .

Considering wound symptoms assessment and level of powerlessness among studied patients pre/post treatment sessions . As noticed, more improvement was found in post and follow – up tests compared to pre as regards : Pain with dressing , exudates , bleeding , wound smell , itching and pain from wound . **Pemayun et al. (2015) & Fedorko et al. (2017)**^(2,11) supported the previous findings and reported that HBOT had a true beneficial effect on improving the quality of life and safe alternative management for patients with diabetic foot ulcers . As regards powerlessness level **Almeida et al. (2014)**⁽²⁴⁾ reported that 71% of patients with diabetic foot ulcers had very strong feelings of powerlessness , feel uncomfortable, discouraged and losing control of their own lives . Moreover , lower limb wounds negatively interfere in the quality of life of leading to mobility limitation with decreased functional status, thus affect daily living activities and intensifying patients` dependency needs and consequently increase feelings of powerlessness .

V. Conclusion

On light of the present study results , it can be concluded that the multimodal preparation package had a positive effect on management of health needs (physical, social, psychological, spiritual and educational) among the studied patients undergoing HBOT in conjunction to standard treatment . Moreover , significant improvement in wound symptoms and level of powerlessness was indicated post treatment among the studied patients that possibly attributable to better ulcers healing .

VI. Recommendations

- An awareness program should be held for such group of patients with HBOT
- -Patients are in need to a simplified illustrated and comprehensive Arabic booklet including information about HBOT .
- -Continuous assessment of health needs for such group of patients with HBOT .
- Prospective studies are needed to assess the long-term success of HBOT and follow up patients` health needs .
- Further studies should be carried out on a large number of such group of patients for evidence of the results and generalization .

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