



Factors Influencing Using Scalp Cryotherapy to Promote Hair Regrowth in Breast Cancer Patients Receiving Chemotherapy

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ABSTRACT

The success of scalp cooling in controlling chemotherapy-induced alopecia (CIA) is highly variable between patients receiving chemotherapy regimens, and hair re-growth is often unpredictable and depends on various factors. **Aim** of this study is to investigate factors influencing the use of scalp cryotherapy to promote hair re-growth in breast cancer patients receiving chemotherapy. **Study design:** A descriptive explorative design was used to achieve the aim of the current study. **Subject:** A purposive sampling of fifty adult patients was recruited for the conduction of this study. **Setting:** The study was conducted in the Hope Cure Oncology Center at Mansoura City. **Data collection tools:** four tools were used to collect data: 1) Breast cancer patients' Structured Interview Questionnaire, 2) Modified WHO Hair Loss Scale, 3) Hair Re-Growth Scale and 4) Factors influencing Hair Re-Growth with Cryotherapy Questionnaire. **Results:** There were highly statistically significant differences between age, marital status, disease stage, duration of the disease and number of chemotherapies of the studied patients with relation to factors influencing hair re-growth at ($P < 0.001$). Also, there were statistically significant difference between patients' educational level, living status, cost of treatment, occupation, type of chemotherapy drugs and factors influencing hair regrowth at ($P < 0.05$). **Conclusion:** Consistent with study questions, Cryotherapy provides significant successful protection from hair loss during cancer chemotherapy course, and for 2 months after completing the treatment. **Recommendations:** Further researches should be done to evaluate the effectiveness of scalp Cryotherapy when using the combination chemotherapy with high doses and with more chemotherapeutic cycles.

Keywords: Scalp Cryotherapy, Chemotherapy-Induced Alopecia, Breast Cancer, Hair Regrowth

Introduction:

Breast cancer is a malignant tumor arising in the cells of the milk-producing lobules, and less commonly in the fatty and fibrous connective stromal tissues of the breast (**Eismann et al., 2019**). According to the American Cancer Society (ACS), 41,760 women were expected to die as a result in 2019. However, due to the advances in treatment, death rates from this disease have been decreasing since 1989 (**Tabár et al., 2019**). In Egypt, it is the most common malignancies in women and accounting for 38.8% of all cancers (**Bahnassy et al., 2015**).

According to ACS, (2020), estimations, 276.480 new cases of invasive breast cancer were diagnosed in women. In United States, 48.530 new cases of carcinoma in situ (CIS) diagnosed, and 42.170 women will die from breast cancer at 2020. Carcinoma of the breast is the most prevalent cancer among Egyptian women. Median age at diagnosis is one decade younger than in countries of Europe and North America and most patients are premenopausal, and hence, it has particularly marked familial, societal, and economic consequences (**Bray et al., 2018**).

Treatment of Breast cancer includes different modalities, and the choice from them depends on several factors such as type and stage of the cancer, patient's age, general

health, sensitivity to hormones, and personal preferences (**Trail, Dubowchik and Lowinger, 2018**). The treatment especially chemotherapy causes many side effects including alopecia, which influence the patients' quality of life either directly or non-directly (**Nurgali, Jagoe, and Abalo, 2015**). Alopecia is ranked as the second most distressing side effect of chemotherapy by patients (**Soref and Fahl, 2015**). While it is not directly leading to mortality, it influences the patients' treatment compliance, in addition to their social and psychological wellbeing (**Belum et al., 2015; Haque et al., 2020**).

Hair starts to re-grow within one to three months after the end of chemotherapy. It often takes six to twelve months to re-grow completely with its texture coarse and color, but it may be different than before (**Chambers et al., 2019**). Scalp cryotherapy consists of wearing a cap or head covering that cools the scalp before, during, and after chemotherapy. It can prevent or reduce hair loss through vasoconstriction of the scalp blood vessels, which decreases blood flow; that in turn reduces the amount of drug that reaches the hair follicles. The first commercial cold cap was used successfully in the early 80s. Recently, it involved the use of newer generation of gel-filled cryogel caps (**Chae, Ng, and Chan, 2018**).

Many factors beyond the type of chemotherapy and dose of drugs influence how effective the procedure is. For example, the ability of patient to tolerate cold temperature, amount of pre- and post-cooling time allotted, thickness and length of the patient's hair, and how well the cap is fitted are some of the key factors. Anxiety can also reduce tolerability to scalp cryotherapy (SC), which can reduce its effectiveness (**Peterson, Lustberg, and Tolaney, 2020**)

Nurses have an important role with patients undergoing chemotherapy to enhance the effectiveness of treatment and avoid its adverse effects. Nursing interventions include prevention and management of alopecia by promotion of hair regrowth (**Gianotti et al., 2019**). The nurse has many roles before, during, and after the cryotherapy, in addition to educate patients precautions and practices to achieve maximum quality of care (**Munzone et al, 2019**).

Significance of the study

Alopecia may cause patients to limit social activities and refuse treatment for fear of losing their body image, self-esteem, and sexuality. Women undergoing chemotherapy may find difficulties in using wigs, because it feels strange, hot or uncomfortable. Therefore, major interests are focused on scalp cooling, which can result in a high level

of retention or complete hair preservation, with consequent improvement of patients' self-confidence, motivation and participation in therapy in addition to improvement of patient quality of life. Moreover, it is a simple procedure that does not need much preparation or resources, with ease of use and application (**Rugo et al., 2017**).

After reviewing literature related to the specific topic, the researchers found many researches discussed Cryotherapy but not for breast cancer patients. A comprehensive understanding of the interplay amongst the myriad factors that influence scalp cooling has clearly not yet been achieved. It is clear that more work remains to be done to obtain the best hair retention results for chemotherapy patients (**Komen et al., 2016**). Reducing such these side effects will help in preventing related complications which consequently reduce cost of health care services, limit hospitalization time, and improve psychological condition of the patients.

Aim of the Study:

The aim of this study is to investigate Factors Influencing the Use of Scalp Cryotherapy to Promote Hair Re-growth in Breast Cancer Patients Receiving Chemotherapy. This aim was achieved through the following objectives:

- Assess hair loss associated with

chemotherapy use.

- Evaluate hair regrowth rate in breast cancer patients undergoing chemotherapy after use of cryotherapy.
- Explore factors influencing hair regrowth with scalp cryotherapy.

Research questions:

To achieve the aim of this study, the following research questions were formulated:

1. Does scalp cryotherapy promote hair regrowth in Breast Cancer patients undergoing chemotherapy?
2. Are there factors influencing hair regrowth with scalp cryotherapy in Breast Cancer patients undergoing chemotherapy?

Operational Definitions:

Scalp Cryotherapy: Is a type of treatment uses cold caps on the head before, during, and after chemotherapy to prevent hair loss after using chemotherapy and promote hair regrowth.

Subject and Methods:

Research Design:

A descriptive explorative design was used to conduct the study.

Research Setting:

The study conducted at Hope Cure oncology Center at Mansoura City, which is one of the first integrated tumors centers at the governorate. It offers a state-of-the-art

techniques and advanced treatment options for oncology patients. The center contains specialized oncology clinic; chemical, biological and immunological treatment; radiotherapy unit; early detection diagnostic unit; tumor marker laboratory; mental health clinic; plastic clinic; a clinic specialized in oncology surgery; in addition to chemotherapy unit supplied with Paxmam Orbis machines.

Subjects:

The study was implemented on a purposive sample consists of 50 female patients having breast cancer and attend to the study setting to receive chemotherapy during the time of the study according to some inclusion criteria such as: Patients aged from 20 to 50 years old, diagnosed as having first and second stage primary breast cancer, receive chemotherapy at the end of the last cycle (cycle 4), and after 2 months of treatment. Some exclusion criteria as Patients who had combined course of chemotherapy and radiotherapy, receiving other drugs that cause hair loss, Patients who are bald or had debilitating scalp/hair problems, as dryness, thinning or splitting before the onset of chemotherapy, Patients with cold sensitivity, had a tendency of thermocoagulation. Moreover, patients with comorbid diseases such as liver diseases, diabetes mellitus, ischemic heart diseases, anemia.

Sample size:

Sample size calculation was based on difference effect of scalp cryotherapy in preventing alopecia in breast cancer patients treated with chemotherapy retrieved from previous research (**Mohammed, 2018**) using g*power version 3.0.10 to calculate sample size, α error = 0.05 and power = 90.0% with the calculated sample size to be 50.

Tools of data collection: Four tools were used to collect data as the following:

Tool (I): Breast cancer patients' Structured Interview Questionnaire:

It was developed by the researchers and included three parts which are:

Part (1): Socio-demographic characteristics:

This part included seven items as age, marital status, residence, education level, living status, occupation and cost of treatment.

Part (2): Health History and Health Status:

This part included six items as types of chemotherapy drugs, disease stage, operation type, lymph nodes dissection, duration of the disease and number of chemotherapy (cycles).

Part (3): Assessment of Hair loss and scalp condition:

It included four questions to ask about suffering from hair loss, time of hair loss, grades of hair

loss, is the hair loss be present before chemotherapy or at which chemotherapeutic cycle.

Tool (II): Modified WHO Hair Loss

Scale:

This scale was developed by WHO and it was used in this study to assess the physiologic measurement of hair loss before and after each cycle of chemotherapy and is intended to measure the severity of hair loss according to the duration of chemotherapy. It was adopted from **Aka and Rajput (2015)**. The patients head observed, measured at the end of the last cycle (cycle 4) of chemotherapy. The difference pre and after the cycle is ranked according to WHO criteria and the difference between the current cycle and the previous cycle measurement is ranked according to WHO criteria. This tool took 10-15 minutes to be completed by the researchers for each patient.

Scoring System:

The scale has a grading for hair loss as follows: grade 0 = none (no hair loss), grade 1 = less than 25% (minimal hair loss), grade 2 = 25% to less than 50% (moderate hair loss), grade 3 = 50% to less than 75% (extensive hair loss) and grade 4 = 75% + (complete hair loss). Grades 0:2 are considered as successful protection, whereas 3:4 indicate failure. The percentages were transferred into grades that scored as Mild = (0 to 5), Moderate = (6 to 8),

Severe = (9 to 11), and Extreme = (12 to 15).

Tool (III): Hair Re-Growth Scale:

The scale adopted from **Chamberlain & Dawber, (2003)** to assess hair growth rate (mm/month) within the scalp. The researchers evaluated hair regrowth after the first and second months from the fourth cycle of chemotherapy and at the end of the last cycle as a baseline for comparisons with follow-up at the first and second months after completion of chemotherapy course.

Hair length was measured by placing a tiny calibrated tube over patient hair and measuring from the scalp to the hair tip regardless of location; 10 hair strands from different areas of the scalp were measured, and their average length was taken as an indicator for hair re-growth. Consistency from one measurement to the next was ensured, and the measurements were then recorded. This tool took 10-15 minutes to be measured by the researchers.

Scoring System:

It classified scalp hair growth into four categories as follows: 0mm hair length/month means no growth (i.e. not improved), less than 2.5 mm refers minimal to definite growth without substantial covering of the thinning area (i.e. slight but definite improvement), 2.5 to less than 5.0 mm /month means moderate to new growth that partially covers the

thinning area (i.e. marked improvement), and 5.0 to at least 7.5 mm /month means dense growth to full coverage of thinning areas (i.e. very good improvement).

Tool (IV): Factors Affect Hair Re-Growth with Cryotherapy:

It was adapted from (**Shin et al., 2015**). This part contains 22 questions classified into four domains as personnel factors consists of 5 questions, environmental factors consist of 4 questions, disease-related factors consist of 9 questions, and psychological factors consists of 4 questions. This tool took 10-15 mints to be fulfilled. It was completed by the researchers through asking the females questions and mark in the tool.

Personnel Factors ask about the relation of patient's age, gender, the presence of financial pressures and living conditions, the nature of the work, and Heredity role in the hair loss process. Environmental Factors ask about the availability of family support, the hospital environment (cleanliness - ventilation - calmness - providing appropriate care), nutrition and the length of hospital stay role in the hair loss process.

Disease-related factors ask about the duration of the disease, the timing of treatment, the dose prescribed, the pathological stage of the disease, surgical

intervention, the method of taking the treatment, taking other means of treatment, accompanying diseases, and herbal treatment role in the hair loss process. The psychological factors ask about providing psychological support from friends and family, the presence of models of recovered individuals, constant anxiety about illness and treatment, and fear of illness role in the hair loss process.

Scoring System:

Scoring of the tool was performed using five Likert scale. Scores ranged from strongly agree (5), Agree (4), Not sure (3), Disagree (2), and Strongly disagree (1). The total scoring system ranged from 22 as the minimum to 110 as maximum, and then the average was taken for each domain, and transformed into percentages from 100%.

Validity:

The content validity established by a panel of five expertise (five professors of medical – surgical nursing), the panel reviewed the tools for clarity, relevance, comprehensiveness, understanding, applicability and simplicity for implementation and some modifications were done on the tool. Face validity verified that, the instrument is valid or give the appearance of measuring the content desired for a study, while content - related validity examines the

extent to which the method of measurement includes all the major elements relevant to the construct being measured (**Grove & Gray, 2018**).

Reliability:

Testing reliability of the proposed tools was done statistically using split half methods and Cronbach's alpha that measures the degree of reliability for the entire form. Both techniques showed high reliability of the final version of the tool, (0.85) for the structured interview questionnaire, (0.87) for modified WHO hair loss scale and (0.84) for the hair re-growth scale.

Pilot study:

The pilot study was done on 10% (five patients) of the sample size to test the feasibility, applicability and clarity of the data collection tool. It served to estimate the time needed to conduct the questionnaire. Minor modifications were done on tool one only based on the results of the pilot study. So, the pilot study included in the study.

Field work:

The actual field work of this study started at the beginning of May 2021 and had been completed of January 2022. This period of time was divided into four phases as following:

1) Preparation phase:

The researchers reviewed the literature related to the topic to prepare the study tools; an approval was obtained through official channels. Then, the researchers met the medical and nursing directors of the health center and explained the aim of the study to gain their approval. After getting the necessary approvals to proceed with the proposed study, subjects who met sampling criteria and agreed to participate in the study were interviewed by the researchers to implement scalp cooling after explanation of the purpose of the study.

Each patient interviewed individually in order to collect the necessary data using the study tools, human rights and ethical consideration, prior to the pilot of this study, a clarification of the nature and purpose of the study done on the interview with each patient. The researchers emphasized that participation is absolutely confidential. Anonymity, privacy, and safety assured throughout the whole study and the right to withdraw from the study at any time.

2) Assessment and planning phase:

The researcher collects baseline data using structured interview questionnaire (tool I), physiologic measurement tool for hair loss by using the WHO grading system (2015) of

hair loss at the end of the last cycle (cycle 4) of chemotherapy (tool II), hair re-growth scale (tool III), and factors affect hair re-growth with cryotherapy (tool IV). The patient was given the choice to participate in scalp cooling. Patient decides to undertake scalp cooling then a verbal consent was taken from the patient to participate in this procedure. Taken within pre assessment or prior to scalp cooling commencing.

3) Implementation phase:

The researchers attended to the center two days weekly and stay (from 11.00 am to 8.00 pm), interviewed each patient individually at the waiting room of chemotherapy unit at clinical oncology center, During the administration of chemotherapy to the patients under study; scalp cooling was provide using scalp cooling machine (Orbis paxman scalp cooling machine). It was applied to the scalp half an hour before starting chemotherapy, during chemotherapy and an hour after accomplishing chemotherapy. Temperature kept at -3Co.

The first interview was implemented before starting the first chemotherapy cycle to collect baseline data that included socio demographic data, current and past medical history, and hair assessment by using tool I (structured interview questionnaire). The second interview was done at the end of the

chemotherapy cycle to collect data about hair loss using tool II (physiologic measurement tool for hair loss by using WHO grading system). The interview took almost 20 minutes for each patient.

4) Evaluation phase:

It was emphasized on data collection by the researchers for evaluation of hair regrowth using Hair Re-growth Scale (tool III) at the end of last cycle (cycle 4), after 1-month follow-up, and After 2-months follow-up. The evaluation phase took three months and it was implemented from first of November 2021 till the end of January 2022.

Ethical considerations:

Before starting the work, an approval obtained from scientific research and ethics committee of the Faculty of Nursing. The researchers clarified the aim of the study to all potential participants and get their consent. Participants assured that anonymity and confidentiality was guaranteed, and they informed about their right to refuse or withdraw from the study at any time. The study procedures do not entail any harmful effects on participants.

III- Statistical Design:

Data analyzed using SPSS (Statistical Package for Social Sciences) version 22. Qualitative data presented as frequencies (n) and percentages (%). Quantitative data tested for normality using Kolmogrov-Smirnov test then described as mean and standard deviation for normally distributed data and median and range for non-normally distributed. The statistical test applied using **Fisher's exact test**, for categorical variables. The significance level was set as follows: Non significant (NS) when $P > 0.05$; Significant (S) when $P < 0.05$ and Highly Significant (HS) when $P < 0.01$. Student-t test and Mann Whitney U test for continuous variables.

Results

Table 1 shows that less than half (44%) of study sample was in the age group from $20 < 35$ years old. More than two-thirds (80 %) of the women were married. As regard to residence, more than half (60 %) of the study sample live in rural area. Regarding to educational level of the women, slightly less than three-quarters (72 %) have secondary education. The majority of the study sample (84 %), live with family. In relation to occupation there were three-fifths (60 %) from the patients were housewives.

Table (2) shows distribution of the studied patients regarding health history and health status. the results showed that more than half (52%) of patients were treated with Endoxan, around two-thirds (64%) of patients were at the 2nd stage of disease, more than half (60%) were undergone breast conservative surgery, more than half (56%) of patients complain of the disease since 1 to 3 years. less than half of patients (46%) were in the second cycle of chemotherapy, the majority (92%) of patients were suffering from hair loss, and (92%) of patients suffering from hair loss after 21 days from starting chemotherapy.

Figure 1 shows distribution of the studied patients with regard to extent of hair loss with using cryotherapy according to WHO scaling system. It was observed that the minority (4 %) of the studied patients suffering from complete hair loss, (8 %) of patients had extensive hair loss, while there was a success rate (grade 0, 1, 2) in the study sample by (88 %).

Figure 2 shows distribution of studied patients with regard to hair loss. In this figure, less than two-thirds (60 %) of the studied patients had mild hair loss (0t to 5), followed with (20 %) had moderate hair loss (6 to 8), (14 %) had sever hair loss (9 to 11), and only (6 %) had extreme hair loss (12 to 15).

Table 3 illustrates distribution of the studied patients using cryotherapy regarding Hair re-growth at various assessment phases. It was showed that there were less than half (40% & 44%) of the studied patients had no hair re-growth (0mm) and minimal growth (<2.5 mm) at the end of cycle 4 respectively. However, after the first months of follow-up, hair re-growth improved in the studied patients by (40%) had moderate re-growth (2.5 to <5.0 mm). By the end of the second month of follow-up, the percentage improved to reach 52% with dense hair re-growth.

Table 4 shows Distribution of Factors influencing Hair Regrowth in the studied patients. In this table, it was showed that nearly half (48%) of the studied patients strongly agreed that psychological factors followed by environmental, disease-related, and personal factors (75%, 60%, and 36%) influencing hair regrowth. In addition, more than one-third (36%) agreed that personal factors followed by disease-related factors, environmental factors, and psychological factors influencing hair regrowth by (47%, 36%, 35%, 25%) respectively.

Table 5, illustrates the relation between socio-demographic characteristics and factors influencing hair regrowth. The results showed that, there was highly statistically significant difference between age

and marital status of the studied group and factors influencing hair regrowth at ($P < 0.001$). Also, there were statistically significant difference with patients' educational level, living status, cost of treatment and occupation of the studied patients and factors influencing hair regrowth at ($P < 0.05$).

Table 6 represents the relation between health history/health states and factors affecting hair regrowth among study group. The results showed that, there was highly statistically significant difference between duration of the disease and number of chemotherapy cycles among the studied group and factors affecting hair regrowth at ($P < 0.001$). Also, there were statistically significant difference type of chemotherapy drug, disease stage, operation type and lymph nodes dissection among the studied group and factors affecting hair regrowth at ($P < 0.05$). Disease-related factors were highly related with type of chemotherapy drug, disease stage, operation type and lymph nodes dissection. Also, personal factors were highly related with duration of the disease, and number of chemotherapy (cycles).

Table 1: Percentage distribution of the studied patients with regard to socio-demographic characteristics (No=50)

Socio-demographic Data	No	%
Age (years)	22	44
20 < 35		
35 < 50	20	40
50 ≤ 60	8	16
Mean ± SD	32.7 ± 3.6	
Marital Status		
Single	2	4
Married	40	80
Widow	4	8
Divorced	4	8
Residence		
Rural	30	60
Urban	20	40
Educational Level		
Read and write	4	8
Secondary education	36	72
Academic education	10	20
Living Status		
live with family	42	84
live alone	8	16
Occupation		
Student	0	0
Employee	18	36
House wife	30	60
Retired	2	4
Cost of Treatment		
Patient with himself	34	68
Supported	16	32

Table 2: Percentage distribution of the studied patients with regard to health history and health status. (No=50)

Health History and Health Status	Study group (No=50)	
	No	%
Type of Chemotherapy Drugs		
Paclitaxel	8	16
Endoxan	26	52
Foulox	16	32
Disease Stage		
1 st Stage	18	36
2 nd Stage	32	64
Operation Type		
Total mastectomy	20	40
Breast conservative surgery	30	60
Lymph nodes dissection		
No	34	68
Yes	16	32
Duration of the Disease		
Less than a year	10	20
From 1 – 3 years	28	56
More than 3 years	12	24
Number of chemotherapy (Cycles):		
Cycle 1	9	18
Cycle 2	23	46
Cycle 3	18	36
Suffering from hair loss		
Yes	46	92
No	4	8
Time of hair loss		
After 21 days	46	92
Others	4	8

Figure 1: Percentage distribution of the studied patients with regard to extent of hair loss with using cryotherapy according to WHO scaling system.

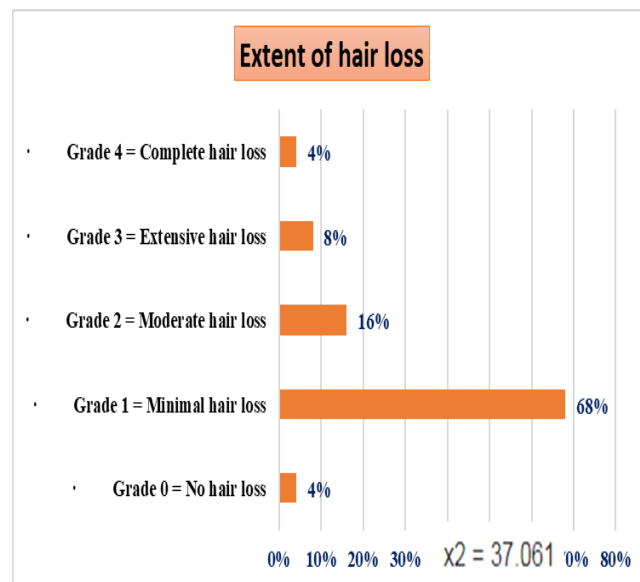


Figure 2: Percentage distribution of studied patients with regard to hair

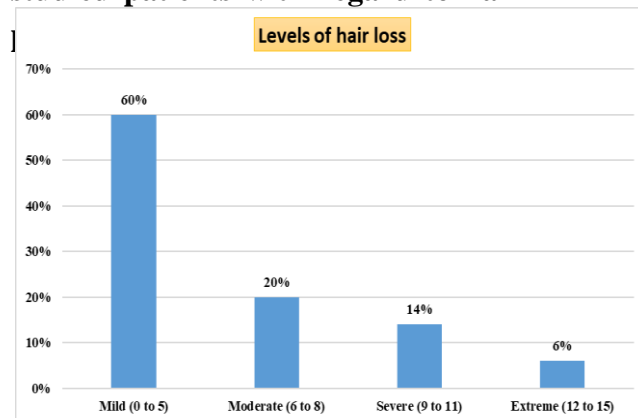


Table 3: Hair re-growth in the studied patients using cryotherapy at various assessment phases (n=50).

Hair re-growth Rate	N0	%
End of cycle 4		
No growth (0mm)	20	40
Minimal growth (<2.5 mm)	22	44
Moderate growth (2.5 to <5.0 mm)	8	16
Dense growth (5.0 to ≥7.5 mm)	0	0
After 1-month follow-up		
No growth (0mm)	4	8
Minimal growth (<2.5 mm)	14	28
Moderate growth (2.5 to <5.0 mm)	20	40
Dense growth (5.0 to ≥ 7.5 mm)	12	24
After 2-month follow-up		
No growth (0mm)	4	8
Minimal growth (<2.5 mm)	10	20
Moderate growth (2.5 to <5.0 mm)	10	20
Dense growth (5.0 to ≥ 7.5 mm)	26	52

Table 4: Percentage Distribution of the Total Average Regarding Factors influencing Hair Regrowth in the studied patients (n=50).

Factors	Strongl agree	Agree	Not	Disagre	Strongl disagree
Personal factors	21%	47%	21%	12%	0%
Environmental factors	60%	35%	5%	0%	0%
Disease-related factors	36%	36%	27%	1%	0%
Psychological factors	75%	25%	0%	0%	0%
Total Average	48%	36%	13%	3%	0%

Table 5: Relation between socio-demographic characteristics and factors influencing hair regrowth in the studied patients.

Factors	Pers nal	Envir- nment	Diseas -	Psycho -icalol	χ ²	P. value
Age (years)	18	10	9	13	17.	0.009
Marital Status	17	8	10	15	14.	0.008
Residence	12	9	13	16	3.1	0.45
Educational Level	14	12	11	13	9.7	0.022
Living Status	15	13	8	14	10.	0.042
Occupation	12	12	13	13	7.7	0.048
Cost of Treatment	11	12	12	15	6.4	0.036

Discussion

Although chemotherapy induced alopecia is a harmless or painless condition; it can significantly affect body image, self-esteem, and sexuality (Mohammed, 2018). As a result, alopecia may motivate patients to limit social activities and refuse treatment. Women undergoing chemotherapy find difficulties in using wigs as they feel strange, hot or uncomfortable. Therefore; (Rugo, Melin, and Voigt, 2017) reported that patients who receive chemotherapy mainly for breast cancer and use cryotherapy appears to have a positive effect on reducing the amount

of alopecia as it may be considered as a therapy for controlling alopecia.

This study aimed to explore factors influencing the use cryotherapy on promoting hair regrowth in cancer patients undergoing chemotherapy. The discussion of the findings included patient's socio-demographic characteristics, health history and health states, effectiveness of scalp cooling in prevention of hair loss according to WHO scaling system for hair loss and factors influencing hair re-growth.

Regarding socio-demographic characteristics; results of the current study revealed that less than half of the studied patients were in the age group ranged from 20 < 35 years old. These findings were in disagreement with the findings of **(Auvinen et al., 2017)**, who found that most of the participant patients' age ranged from 40 – 49 years old. This may be due to females' exposure to more stressors, nutritional deficiency, obesity, and hormonal changes at that age.

Regarding marital status; the majority of the studied patients were married. These findings were in an agreement with **(Massey, 2018)** who found that the majority of the studied patients were married. This may be due to that the women included in the study aged from 20-60 years old “the productive life” so it is normally for the

majority of them to be married. This may indicate that marriage associated problems may result in cancer either by increasing work load, responsibilities or stress.

Concerning educational level of the studied participants, the majority of patients had secondary education and live with their families, and slightly more than half reside rural areas. This result was consistent with **(Peck, Mitchell, and Stewart, 2018)** who found that most of the patients had secondary education, reside rural areas and live with their families. This difference may be due to the difference between countries regarding awareness and culture. This level of education may affect the level of awareness and understanding regarding the preventive information of the cancer and also the importance of its early detection through the scheduled follow-up.

Regarding type of operation; patients in the current study have different stages of cancer and undergone various types of operation accordingly as, more than half of the studied patients undergone breast conservative surgery and the rest undergone total mastectomy. This result is agreed with a study done by **(Nangia et al. 2017)**, who reported that the studied patients undergone several types of operations as total mastectomy. The result was contradicted with the study result done by **(Roseman,**

2018), whose study group undergone mastectomy only. This mean that the author who stabilize the type of operation for the study group want to stabilize the type of chemotherapy and examine the effect of scalp cooling on that medication while who used several types of cancer operations want to examine the effect of scalp cooling on different types of chemotherapy used after these operations. The majority of patients had mastectomy because the studied sample were female, this finding was matched with the National Cancer Institute, which report that majority of breast cancer cases are females (**American Cancer Society, 2020**).

Regarding disease stages; more than half of the studied patients were at the second stage of their disease, and complain the disease from one to three years. This result is agreed with the study done by (**Rugo et al., 2017**), whose patients were at the early stage of disease and the length of the disease occurs within 1-3 years in most of patients.

The results of the current study revealed that after the last chemotherapy session there were a significant improvement in the studied patients with success rate in the majority of patients as they had (grade 0, 1, 2) of hair loss. Additionally, less than one-quarter from the studied patients need to wear a wig as they

had (grade 3& 4) of hair loss. These results were in agreement with a study done by (**Peck et al., 2018**), who found that most of patients in the study group not required to wear a wig (grade 0, 1, 2) and all of patients in the control group required to wear a wig (grade 3, 4). The result also was agreed with the result of the study done by (**Lemenager, Lecomte, and Bessa, 2018**) who reported success rate (grade 0, 1, 2) in most of cold caped patients.

The finding was also supported by the study result of (**Lemieux & Maunsell, 2008**) who found that there was success rate of (grades 0, 1, 2) in the majority of scalp cooled patients. The study results also were consistent with the study by (**Hurk et al., 2010**), who achieved success rate in half of the patients who didn't require to wear a wig (grade 0, 1, 2). However, the finding was disagreed with the result reported by (**Mols et al., 2018**), who reported that the success rate only (10%) from the scalp cooled patient that was nearly similar with the control group.

This difference may be due to that the last authors used manual caps kept at 8c° and remained on the scalp for 15 minutes only after infusion of chemotherapy, and the scalp cooling as reported by most references should be applied 30 minutes

before starting chemotherapy and during infusion period and after accomplishing chemotherapy from 30-90 minutes and the cooling temperature should be kept below - 25c° such as the current study which utilized scalp cooling types that deliver cooling to the scalp according to these references.

According to the present study findings; successful protection from hair loss was demonstrated as there was a significant improvement in the studied patients. This successful protection started early at the end of cycle 4, and continued to the first and second month of follow-up period. The findings were in congruence with **(Kinoshita et al., 2016)** who reported that patients received scalp cooling lost significantly less hair than those who had the standard treatment. From the researchers' point of view, this indicates that the risk and severity of hair loss decreased with cryotherapy.

The findings of the present study revealed significant improvement in the patients' hair regrowth started one month from completion of the chemotherapy course, and continued to the second month of follow-up. On the same line, **Hackbarth, Hass, and Fotopoulou (2019)** observed better hair regrowth after discontinuation of chemotherapy course for patients using scalp cooling. They explained that hair

follicles respond greater to rapid cell growth phase which would accelerate the hair cycle and thereby stimulate regrowth.

These results were congruent with those of **Munstedt et al. (2016)**, who reported that three-fifths of the studied patients who used scalp cooling had moderate hair growth after 2 months from treatment. Whereas, **Baxley, Kendrick, and Brown, (2017)**, claimed that hair will regrow after finishing treatment between 6 and 12 months. Also, **Mulders, Vingerhoets, and Breed (2018)**, reported that sometimes hair regrowth didn't occur when hair follicles are irreversibly damaged by chemotherapy.

Regarding total average of factors influencing hair regrowth, the present study showed that nearly half of the studied patients strongly agreed that psychological factors followed by environmental, disease-related, and personal factors influencing hair regrowth. In addition, more than one-third of the patients agreed that personal factors followed by disease-related factors, environmental factors, and psychological factors influencing hair regrowth.

This finding was confirmed by **Hosking, Juhasz, and Mesinkovska (2019)**, who stated that multiple factors contribute to hair loss including genetics, hormones, environmental exposure,

medications, and nutrition. And proved that, given the negative psychosocial impact of hair loss, patients that do not see significant hair restoration with conventional therapies often turn to complementary and alternative medicine (CAM). Also, **Guo and Katta (2017)** added that nutrition plays a key role in hair maintenance and may be harmful in deficiency or excess.

Also, this finding was in accordance with **(Cigler et al., 2015)**, who found that cryotherapy has proved the most effective and widely used method to prevent hair loss and promote hair regrowth. Moreover; **Rugo, Melin and Voigt. (2017)** discussed that hair loss is a condition that has significant implications for patients' psychosocial functions. Thus, interventions such as scalp cooling can reduce or eliminate treatment-associated toxic effects and help ease the distress associated with chemotherapy. This was agreed with **Aukerman and Jafferany, (2022)**, who reported that a majority of patients reported loss of self-esteem, negative effects on social life, and increased feelings of depression with hair loss.

Results of the present study proved high statistically significant difference between age and marital status, educational level, living status, cost of treatment and occupation of the studied group and factors

influencing hair regrowth. On the same line, a study conducted by **Kim et al. (2018)**, stated that the level of education, marital status and economic status are significant variables that affect the hair loss.

The results revealed high statistically significant difference between disease stage, duration of the disease and number of chemotherapies of the studied group and factors influencing hair re-growth. Also, there were statistically significant difference with type of chemotherapy drugs and operation type of the studied group and factors influencing hair regrowth in this study. This result agrees with **(Nangia et al., 2017)** who found that, those who underwent scalp cooling were significantly more likely to have less than fifty percent hair loss after the fourth chemotherapy cycle compared with those who received no scalp cooling. Moreover, scalp cooling significantly reduced hair loss in breast cancer patients who received chemotherapy in a randomized clinical study.

Conclusion

Consistent with study questions, scalp cooling provides significant successful protection from hair loss during cancer chemotherapy course, and for 2 months after completing the treatment. There were high statistically significant differences between age, marital status, educational level, living

status, cost of treatment, occupation, disease stage, duration of the disease and number of chemotherapies, type of chemotherapy drugs and operation of the studied group and factors influencing hair regrowth.

Recommendations

Bases on the results of this study, it can be recommended that the nurses should be educated about application of the scalp cooling procedure; study the optimal method, temperature, and duration of cooling with various chemotherapy regimens. Initiate intensive training for cancer women in order to increase their knowledge and awareness with regard to use cryotherapy to prevent hair loss. Further studies to evaluate the effectiveness of cryotherapy when using the combination chemotherapy with high doses and many chemotherapeutic cycles.

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