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Effect of Implementing Educational Program for Nurses' on Prevention of Chemotherapy Extravasations Complications among Cancer Patients

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Abstract: **Background: Chemotherapy extravasations remain an accidental complication of chemotherapy administration and may result in serious damage to patients. Globally, the burden of cancer continues to increase with an expected 19.3 million new cancer cases by 2025. In 2012 (the most recent data available), 14.1 million new cancer cases were diagnosed and 8.2 million people died from cancer. Aim: To evaluate the effect of implementing educational program for nurses' on prevention of chemotherapy extravasations complications among cancer patients. Design: A quasi – experimental design was used. Setting: The current study was conducted in outpatient chemotherapy clinic at Ain-Shams university Hospital. Subjects: Purposive sample included all available (30) nurses and (30) adult patient who had cancer. Study tools: Three tools used for data collection; 1) Nurses socio-demographic characteristics, 2) Observational checklist for chemotherapy administration, 3) Assessment of extravasation complications. Results: Highly statistically improvement in nurse's practice were found post educational program implementation (P<0.000), as well as complications of chemotherapy extravasations were decreased after improvement of nurses practice. Conclusion: There was a significant improvement of nurses' practices regarding chemotherapy administration after educational program. Recommendations: The study recommended the importance of establishing educational programs in all Egyptian oncology centers for alleviating chemotherapy extravasations complications among cancer patients.**

Keywords: **Cancer patients, Chemotherapy, Extravasations complications.**

I. INTRODUCTION

Cancer is a malignant tumors located in different parts of the body; can be disseminated due to the constant and fast cell division process. The World Health Organization (WHO) indicates that 27 million incident cases and nearly 17 million deaths due to cancer are expected to occur in 2030 **(Instituto Nacional de Câncer , 2016)**. In 2012 (the most recent data available), 14.1 million new cancer cases were diagnosed and 8.2 million people died from cancer **(Centers for Disease Control, 2016).**

One of the most medical regimen widely used therapeutic modalities in oncology is chemotherapy, which uses chemical agents, alone or in combination, to treat malignant tumors by interfering with the process of cell division. By acting as a direct action in the cancer cell, these agents can be toxic to tissues with high mitotic activities, causing several adverse effects **(Bonassa, 2012)**. One of these side effects is extravasation, caused by the administration of the chemotherapeutic agent particularly throughout intravenous route **(Dougherty, 2015)**. Chemotherapy extravasation can be defined as an accidental infiltration of chemotherapeutic agent into the subcutaneous tissue during injection **(Chang, Wang, Chen, Chen & Wang, 2014)**.

Risk factors related to patient nurses, training, itrogenic factors and chemotherapy agent can increases risk of chemotherapy extravasation. Also the properties of the drug, drug concentration, volume and duration of drug administration **(Reynolds, MacLaren, Mueller, Fish, Kiser, 2014)**. Also many factors related to patients that can increase the risk of chemotherapy extravasation include small, fragile veins, lymphedema, obesity, impaired level of consciousness, and patients having had previous multiple venipuncture site. Iatrogenic causes and related to staff include, lack of training of nurses, poor cannula size selection, poor location selection and lack of time. Extravasation also can occur due to an accidental puncturing of the vein or upon movement of the cannula itself due to movement of the patient or insecure fixing. Prolonged peripheral line infusions of vesicants carry an increased risk of extravasation and vesicants should not be infused as prolonged unsupervised infusions via a peripheral vein **(Cassagnol, & McBride, 2009)**.

The incidence of chemotherapy extravasation varies greatly due to lack of improper and inaccurate reporting and absence of centralized registration of chemotherapy extravasation events. While center-based guidelines and policies attempt and seek to minimize the side effect and complications can occur from extravasation, chemotherapy extravasation has a prevalence that can be ranged from 0.1% to 6% when the drug administered through a peripheral intravenous access and from 0.26% to 4.7% when drug provided through a central venous access device (CVAD). **(Coyle, Griffie,& Czaplewski, 2014)**.

Chemotherapy extravasations symptoms are wide ranged and can be mild in a form of acute burning pain, swelling, at the infusion site. The symptoms vary according to the amount and concentration of drug leakage and extravasation surround the vein. Pain and erythema, indurations and skin discoloration progresses over few days and weeks, and may progress to blister formation. Blister necrosis and formation can lead to invasion and destruction of deep structures. Damage can reach tendons, nerves, and joints depending on the location of the vein where extravasation occurs **(Coyle, Griffie & Czaplewski 2014)**.

Complication of extravasation may develop necrosis within days but necrotic ulcers usually develop over 7 to 10 days after the extravasation, sometimes enlarging over several months thereafter. Currently, there is no consensus as to what should be done once extravasation has occurred. Antidotal therapy is in dispute and some clinicians maintain that the area must be excised and grafting done immediately **(Diel- Svrjcek BC, et al. 2007)**.

Intravenous (IV) catheterizations should be performed in cancer therapy for drug administration, and transfusion of blood and blood products **(McCallum, & Higgins, 2012)**. The nurses in oncology centers or unites are responsible for the safe and timely administration of treatments to the patients through peripheral and central venous catheter (CVC) and management of any possible complication **(Turkish Ministry of Health Directive about the making changes in Nursind regulations, 2012)**.

The nurses role is remain a vital and important role in the field of oncology and providing of chemotherapy consider a sensitive domain in oncology nursing where little negligence or mistake may lead to sever adverse effects and consequences for patients, staff and environment. The medication errors in chemotherapy are a common (44%) incidence due to lack of specific experience, knowledge and training of the staff in chemotherapy, prescription, preparation and administration. This lacking of knowledge and training of the staff can leads to fatal complications, such as over dose of chemotherapy, wrong calculations of drugs, wrong route of transfusion, which sometimes result in patient's death. Therefore studies have been conducted in past to evaluate the knowledge and attitude of nurses in different specialties, and proved that nurses; knowledge can be enhanced with the help of educational programmers **(Mohamed, 2015)**.

Significance of the study:

Cancer is a one of major cause leading to death worldwide; approximately 10 million people are diagnosed with cancer worldwide and about 6 million of deaths caused by cancer. **(Chien, Chen & Chiang, 2010).** The World Health Organization (WHO) indicates that 27 million incident cases and nearly 17 million deaths due to cancer are expected to occur in 2030 **(Instituto Nacional de Câncer , 2016)**.It has been estimated that there about 15 million new cases every year by 2020 can be diagnosed with cancer. The disease burden is much higher in Egypt than developed countries. The current data on cancer incidence is not available due to unavailability of regular cancer registry system at national level in Egypt **(Kyprianou, Kapsou, Raftopoulos & Soteriades, 2010)**.

Nurses play a fundamental role in the prevention, identification and follow-up of the complications of this adverse event. The nurse's performance requires recent and scientific theoretical and practical knowledge also requires the development of skills to improve performance in an efficient and safe way **(Silva & Cruz, 2015)**. The safety in the process of administration of chemotherapeutic agents is part of the daily routine of nursing, being their responsibility. In order for increase patient safety and prevention of complications and to carry this process safely, it is necessary that the professionals involved in the care have the knowledge, skills and technical skills that are acquired through clinical experience and through educational actions **(Verity, Wiseman, Ream, Teasdale,& Richardson, 2015)**.

Aim of this study:

To evaluate the effect of implementing educational program for nurses' on prevention of chemotherapy extravasations complications among cancer patients

II. SUBJECTS AND METHODS

Research Design: The study utilized a quasi-experimental design.

Setting: The study was carried out in outpatient chemotherapy clinics at the Oncology unit, Ain-Shams University Hospital, Egypt.

Subjects: Purposive sample of (30) nurses worked in outpatient chemotherapy clinic and (30) adult male and female patients who are recently received chemotherapy with the age ranged from 18 to 60 years and agreed to participate in the study. Patients who had chemotherapy extravasation complications were excluded from the study.

Data collection tools: Three tools were used to collect data include:

1. Nurse's socio- demographic characteristics: This tool was developed by the researchers after reviewing the recent related literature. It includes (age, sex, qualifications, years of experience and previous training).
2. Observational checklist for chemotherapy administration**:** This tool was developed by the researchers after reviewing the recent related literature {**Pérez, et al, (2012), Sauerland, et al, (2006) and Langstein, (2002)}.** It is a likert like scale with two options done and not done. It is used to observe nurses practice regarding to chemotherapy administration before and after program implementation and at follow up phase. It contain ten questions (Select a large vein, select a new venipuncture site, make a clean venipuncture, leave the needle entry site visible, have IV flowing freely at all times with normal saline, watch needle tip for evidence of extravasations, check for blood return every 2-3 mL during injection, flush thoroughly with normal saline, elevate limb and teach patient to inform the nurse immediately if discomfort, swelling, redness, pain, burning and fever). The scoring system was graded as, one mark for each step done and zero for not done and the total score for all items ranged from 0 to10.
3. Assessment of extravasation complications**:** This tool was developed by researcher after reviewing review related literature **{Jackson, et al, (2006), and Weiner, et al, (2007)}.** It has contained eleven items (pain, burning sensation, fever, discomfort, redness, ulceration, hematoma, venous spasm, thrombosis, phlebitis and nerve, tendon or ligament damage), and the patients was observed for note complications pre, post program implementation and at follow up to assess the effect of nurses practice on patient complications. The scoring system for this tool as following:

   a). Zero for no symptoms,

   b). 1 score for immediate manifestations and

   c). 2 scores for delayed manifestations

The total scores ranged from 0 to 22.

III. TOOLS VALIDITY AND RELIABILITY

The tools validity was tested by 5 of academic expertise in adult health nursing (medical surgical nursing) from the faculty of nursing. To determine relevance, clarity, completeness and comprehensiveness of the tools, experts provide responses were either agree or disagree for the face validity. Then their opinions are reviewed and final questionnaire

were prepared and used. The reliability of the tools was measured through 10% of the study sample using the established tool and retested after four week on the same sample and the results were the same in each time.

IV. PILOT STUDY

A pilot study was carried out on 10% of sample size, to evaluate the efficiency, reliability, clarity and applicability of the tools, and then the tools were adapted according to the pilot study results. Subjects included in the pilot study not excluded from the total sample as any modifications of study tools were done.

V. ETHICAL CONSIDERATIONS

The ethical research consideration in this study was including the following: 1).The objective and aim of the study explained by the researcher. 2). Subjects were informed that they are allowed to choose to participate or not in the research and that they have the right to withdraw from the research at any time. 3). Data collection was for research only and it executed after data analysis.

VI. FIELD WORK

An approval was obtained from a scientific, ethical committee of the faculties of nursing at Helwan and Ain shams University and the study subjects individually using a written informed consent obtained from each participant before data collection. Sampling was started and completed within six months from July (2018) until the end of December (2018). The data was collected by the researchers for all nurses and patients pre and post the procedure.

Field work will include four phases:

Assessment Phase: The researcher interviewed with nurses and patients included in the study before the procedure to explain aim of the study and take their approval to participate in the study, then the basic assessment was done and data was collected.

Planning Phase: The educational session was designed based on analysis of the actual patients' needs in pre assessment by using the pre constructed tools. The content was written in a simple Arabic language and consistent with the related literatures.

Implementation Phase: The nurses groups divided into three groups; each group 10 nurses. Implementation phase was done in a period of six (6) weeks, two weeks for each nurses group (10 nurses). The researchers gave the nurses the booklet and explained all its contents to the nurses after the procedure to improve their knowledge and practice.

Evaluation Phase: Each nurse was evaluated by the researchers immediately post implementation of the program and after one month implementation using tool II.

Administrative Design:

The present study was carried out after taking an official permission from the administrators of the study settings at oncology center management, Ain-Shams University Hospital, by presented of an official letter taken from the Faculty of Nursing, Helwan University, after the aim of the study were explained clearly.

VII. LIMITATION OF THE STUDY

Nurses working overload interfere education process, lack of equipped place for educational process and also lack of nurse's time and lack of insufficient time from the work place as well as lack of resources at working place.

VIII. STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS for windows version 23.0. Data were tested for normality of distribution prior to any calculations. Continuous data were normally distribute and were expressed in mean ±standard deviation (SD). Categorical data were expressed in number and percentage. The ANOVA test was used to compare between program phases and t-test to compare pre program with post program implementation and post program with follow up phase to assess retention of nurses practice, statistical significance was set at $p<0.05$.

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IX. RESULTS

Table (1): Socio demographic characteristics (Nurses no 30)

Sociodemographic characteristics		Frequency	Percent (%)
1.Age	a. Less than 30 years	23	76.7
	b. 30 years and more	7	23.3
	Mean ±Std. Deviation	**1.23 ± 0.43**	
2.sex	a. Male	8	26.7
	b. Female	22	73.3
3.Nursing qualification	a. Secondary nursing school	4	13.3
	b. Technical nursing institute	24	80.0
	c. Bachelor nursing	2	6.7
4.Years of experience	a. Less than 5 years	18	60.0
	b. 5 years to 10 years	10	33.3
	c. More than 10 years	2	6.7
5.Previous training	a. yes	11	36.7
	b. No	19	63.3
6.Another working place	a. Yes	6	20.0
	b. No	24	80.0

Table (1) shows that the majority of the study nurses (76.7%) were less than 30 years and more than two thirds of them (73.3%) were female. Most of nurses (80.0%) graduated from technical nursing institute and didn't have another working place. In addition, more than half of nurses (63.3% & 60.0%) had no previous training and less than 5 years of working experience respectively.

Figure (1): Distribution of nurses age included in the study (nurses no. 30)

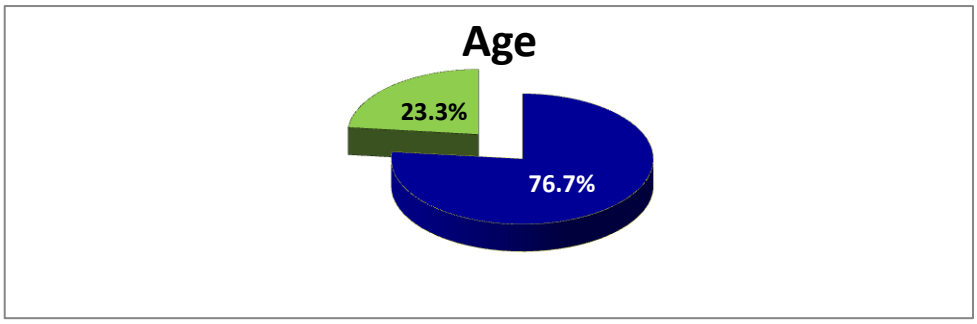

Figure (1) shows that age of the majority of nurses included in the study were less than 30 years (76.7%) while about 23.3% of them were more than 30 years.

Table (2): Nurses practice regarding chemotherapy administration pre and post program implementation (nurses no 30)

Nurses practice observation items	Pre program implementation				Post program implementation				t-value	*P*-value
	Yes		No		Yes		No			
	No	%	No	%	No	%	No	%		
1.Select a large vein away from joints or tendons	16	53.3	14	46.7	29	96.7	1	3.3	4.17	.000**
2.Select a new venipuncture site rather than using previous site	10	33.3	20	66.6	30	100	0	0.00	7.61	.000**
3. Make a clean venipuncture	16	53.3	14	46.7	29	96.7	1	3.3	4.70	.000**
4. Leave the needle entry site visible so that it can be watched during injection.	2	6.7	28	93.3	25	83.3	5	16.7	8.33	.000**
5.Have IV flowing freely at all times with normal saline	4	13.3	26	86.7	24	80.0	6	20.0	6.02	.000**

6.Watch needle tip for evidence of extravasations	1	3.3	29	96.7	24	80.0	6	20.0	9.76	.000**
7. Check for blood return every 2-3 mL during injection.	2	6.7	28	93.3	22	73.3	8	26.7	7.61	.000**
8.Flush thoroughly with normal saline	30	100	0	0.00	24	80.0	6	20.0	10.77	.000**
9. Elevate limb and maintain gentle pressure over the venipuncture site for five minutes after needle withdrawn.	7	23.3	23	76.7	28	93.3	2	6.7	8.22	.000**
10. Teach patient to inform the nurse immediately if discomfort, swelling, redness, pain, burning and fever	12	40.0	18	60.0	29	96.7	1	3.3	6.15	.000**

***: Significant at P ≤ 0.05.**

Table (2) reveals highly statistically improvement in nurses practice post program implementation than pre program implementation at level (P <0.000) in all items with value (4.17, 7.61, 4.70, 8.33, 6.02, 9.76, 7.61, 10.77, 8.22, and 6.15) respectively

Table (3): Observation of nurses practice post program implementation and follow up phase (nurses no 30)

Nurses practice observation items	**Post program implementation**				**Follow up phase**				**t-value**	***P*-value**
	Yes		**No**		**Yes**		**No**			
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**		
1. Select a large vein away from joints or tendons	29	96.7	1	3.3	29	96.7	1	3.3	0.000	1.000
2. Select a new venipuncture site rather than using previous site	30	100	0	0.00	29	96.7	1	3.3	1.000	0.326
3. Make a clean venipuncture	29	96.7	1	3.3	29	96.7	1	3.3	0.000	1.000
4. Leave the needle entry site visible so that it can be watched during injection.	25	83.3	5	16.7	25	83.3	5	16.7	1.649	0.110
5. Have IV flowing freely at all times with normal saline	24	80.0	6	20.0	12	40.0	18	60.0	.372	0.712
6. Watch needle tip for evidence of extravasations	24	80.0	6	20.0	25	83.3	5	16.7	1.542	0.134
7. Check for blood return every 2-3 mL during injection.	22	73.3	8	26.7	17	56.7	13	43.3	1.628	0.103
8. Flush thoroughly with normal saline	24	80.0	6	20.0	20	66.7	10	33.3	0.000	1.000
9. Elevate limb and maintain gentle pressure over the venipuncture site for five minutes after needle withdrawn.	28	93.3	2	6.7	28	93.3	2	6.7	1.795	0.083
10. Teach patient to inform the nurse immediately if discomfort, swelling, redness, pain, burning and fever	29	96.7	1	3.3	26	86.7	4	13.3	0.000	1.000

***: Significant at P ≤ 0.05.**

Table (3) explain that, there was no statistically significant differences between nurses practice at follow up phase compared with post program implementation phase, which mean the nurses have knowledge in post program and follow up phase in all items with t- value (0.00, 1.00, 0.00, 1.649, .372, 1.542, 1.628, 0.00, 1.795, and 0.00) respectively.

Table (4): Total Nurses practice regarding chemotherapy administration pre, post program implementation and follow up phase (nurses no. 30)

Items	**Mean ± Std. Deviation**	**f- test**	***P*-value**
Pre program implementation	17.66 ± 0.99	377.482	0.000**
Post program implementation	11.20 ± 1.03		
Follow up phase	11.80 ± 0.99		

***: Significant at P ≤ 0.05.**

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Table (4) shows that highly statistically significant improvement in nurses practice during post program implementation and at follow up phase at (P <0.000) and with mean ± Std. deviation (17.66 ± 0.99, 11.20 ± 1.03 and 11.80 ± 0.99) respectively.

Table (5): Patient chemotherapy extravasations complications throughout program phases (pain, burning sensation, fever, discomfort and redness), (patients' no. 30)

Patient chemotherapy extravasations complications	Pre program implementation		Post program implementation		Follow up		P-value
	No	%	No	%	No	%	
1. Pain							
a. No manifestations	8	26.7	12	40.0	9	30.0	0.326
b. Immediate manifestations of extravasations	20	66.7	16	53.3	19	63.3	
c. Delayed manifestations of extravasations	2	6.7	2	6.7	2	6.7	
Mean Std. ± Deviation	**1.80 ± 0.55**		**1.66 ± 0.60**		**1.76 ± 0.56**		
2. Burning sensation							
a. No manifestations	3	10.0	19	63.3	20	66.7	0.000**
b. Immediate manifestations of extravasations	23	76.7	10	33.3	10	33.3	
c. Delayed manifestations of extravasations	4	13.3	1	3.3	0	0.00	
Mean Std. ± Deviation	**2.03 ± 0.49**		**1.40 ± 0.56**		**1.33 ± 0.47**		
3. Fever							
a. No manifestations	10	43.3	24	80.0	19	63.3	0.000**
b. Immediate manifestations of extravasations	13	33.3	5	16.7	9	30.0	
c. Delayed manifestations of extravasations	7	23.3	1	3.3	2	6.7	
Mean Std. ± Deviation	**1.90 ± 0.75**		**1.23 ± 0.50**		**1.433 ± 0.62**		
4. Discomfort							
a. No manifestations	9	30.0	21	70.0	21	70.0	0.001**
b. Immediate manifestations of extravasations	15	50.0	7	23.3	8	26.7	
c. Delayed manifestations of extravasations	6	20.0	2	6.7	1	3.3	
Mean Std. ± Deviation	**1.90 ± 0.71**		**1.36 ± 0.61**		**1.33 ± 0.54**		
5. Redness	5	16.7	24	80.0	27	90.0	
a. No manifestations	17	56.7	5	16.7	0	0	0.000**
b. Immediate manifestations of extravasations	8	26.7	1	3.3	3	10.0	
c. Delayed manifestations of extravasations							
Mean Std. ± Deviation	**2.10 ± 0.66**		**1.23 ± 0.50**		**1.20 ± 0.61**		

Table 5 revealed that, significant improvement in patient manifestation related to extravasation complications in all items except to pain, as well as patient with no pain decreased in post program implementation while slightly increased at follow up phase (1.80± 0.55, 1.66 ± 0.60 & 1.76 ± 0.56) respectively. Regarding to burning sensation, the patients who had immediate and delayed manifestation was decreased at post program and at follow up phase (2.03 ± 0.49, 1.40 ± 0.56 & 1.33 ± 0.47) respectively. According to fever the patients suffer from it was decreased in during post program and follow up phase (1.90±0.75, 1.23 ± 0.50 & 1.433 ± 0.62) respectively. Regarding to discomfort there are increased in patient number with no manifestation in post program and follow up phase and the number of patients with immediate and delayed manifestation was decreased at post program and follow up phase (1.90 ± 0.71, 1.36 ± 0.61 & 1.33 ± 0.54) respectively. Regarding to redness there is improvement in patient complication and decreased in post program and at follow up phase (2.10 ± 0.66, 1.23 ± 0.50 & 1.20 ± 0.61) respectively.

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Table (6): Percentage distribution of patients' extravasations complications throughout program phases (patients' no. 30)

Patient chemotherapy extravasations complications	Pre program implementation		Post program implementation		Follow up		P- value
	No	%	No	%	No	%	
1. Ulceration a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 13 11 6	 43.3 36.7 20.0	 25 4 1	 83.3 13.3 3.3	 26 3 1	 86.7 10.0 3.3	0.002**
Mean Std. ± Deviation	**1.76 ± 0.77**		**1.20 ± 0.48**		**1.16 ± 0.46**		
2. Hematoma a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 7 17 6	 23.3 56.7 20.0	 24 5 1	 80.0 16.7 3.3	 26 3 1	 86.7 10.0 3.3	0.000**
Mean Std. ± Deviation	**1.76 ± 0.77**		**1.23 ± 0.50**		**1.16 ± 0.46**		
3. Venous spasm a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 12 13 5	 40.0 43.3 16.7	 25 4 1	 83.3 13.3 3.3	 28 1 1	 93.3 3.3 3.3	0.000**
Mean Std. ± Deviation	**1.76 ± 0.72**		**1.20 ± 0.48**		**1.10 ± 0.40**		
4. Thrombosis a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 17 7 6	 56.7 23.3 20.0	 27 2 1	 90.0 6.7 3.3	 28 1 1	 93.3 3.3 3.3	0.001**
Mean Std. ± Deviation	**1.63 ± 0.80**		**1.13 ± 0.43**		**1.10 ± 0.40**		
5. Phlebitis a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 7 17 6	 23.3 56.7 20.0	 27 1 2	 90.0 3.3 6.7	 25 4 1	 83.3 13.3 3.3	0.000**
Mean Std. ± Deviation	**1.96 ± 0.66**		**1.16 ± 0.53**		**1.20 ± 0.48**		
6. Nerve, tendon or ligament damage a. No manifestations b. Immediate manifestations of extravasations c. Delayed manifestations of extravasations	 19 9 2	 63.3 30.0 6.7	 26 2 2	 86.7 6.7 6.7	 29 0 1	 96.7 0 3.3	0.147
Mean Std. ± Deviation	**1.43 ± 0.62**		**1.20 ± 0.55**		**1.06 ± 0.36**		

Table 6 illustrate that, number of patients with no manifestation increased in post program and follow up while patients with immediate and delayed manifestation was decreased post program and at follow up phase regarding to all items. Ulceration, hematoma, venous spasm, thrombosis, phlebitis and nerve damage (1.20 ± 0.48, 1.23 ± 0.50, 1.20± 0.48, 1.13 ± 0.43, 1.16 ± 0.53 & 1.20 ± 0.55) respectively during post program implementation phase, and the patients had significant improvement in all items except nerve, tendon or ligament damage.

Table (7): Total mean scores of patient extravasations complications throughout program phases (Patient n. 30)

Items	Mean Std. ± Deviation	f- test	P-value
Pre program implementation	20.26 ± 3.26	41.729	0.000**
Post program implementation	14.03 ± 3.20		
Follow up phase	13.86 ± 2.78		

***: Significant at P ≤ 0.05.**

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Table (7) shows that, highly statistically significant improvement regarding to extravasations complications post program implementation and follow up phase at (P <0.000**) and with mean ± Std. deviation (20.26 ± 3.26, 14.03 ± 3.20 & 13.86 ± 2.78) respectively.

Table (8): correlation coefficient between nurse's practice and patient complications of chemotherapy extravasations

Correlation	Patient complications pre program implementation	Patient complications post program implementation	Patient complications follow up phase	Nurses practice pre program implementation	Nurses practice post program implementation	Nurses program follow up phase
-Patient complications pre program implementation	**1**	**.121**	**.186**	**.018**	**-.651****	**-.152-**
-Patient complications post program implementation	**.121**	**1**	**.839****	**.090**	**-.222-**	**.110**
-Patient complications follow up phase	**.186**	**.839****	**1**	**.046**	**-.182-**	**.226**
-Nurses practice pre program implementation	**.018**	**.090**	**.046**	**1**	**-.269-**	**-.104-**
-Nurses practice post program implementation	**-.651****	**-.222-**	**-.182-**	**-.269-**	**1**	**.309**
-Nurses program follow up phase	**-.152-**	**.110**	**.226**	**-.104-**	**.309**	**1**

*****. Correlation is significant at the 0.01 level (2-tailed).***

Table (8) refer to, there are a negative correlation between nurses practice post program implementation phase and complication of chemotherapy extravasations pre program implementation, while there are positive correlation of patient complications post program and follow up phase.

X. DISCUSSION

The frequency of chemotherapeutic drug extravasation varies widely; ranging from 0.5 % to more than 6 %. The degree of severity resulting from extravasation is dependent on the specific drug administered and its concentration, the amount of drug extravasated, the length of tissue exposure to the drug and the site of extravasations **(Bellin, Jakobsen, & Tomassin 2010)**.

Part I: Socio demographic characteristics of the studied nurses.

As regard nurses characteristics of this study, the results revealed that the majority their ages less than 30 years and their mean age was 1.23 ± 0.43, female, this goes in the same line with **Mohamed (2015)**, who said that the majority of the nurses ages ranged from 20- 30 years, female in a similar study "effect of a designed nursing intervention protocol on nurse's knowledge and practice regarding chemotherapy" .

In relation to nurses years of experiences of the studied nurses; the present study revealed that the majority of them had their experiences less than 5 years. This result in accordance with **Hassan (2006),** who reported that, about evaluation of nursing care to cancer patients who are receiving chemotherapy that more than two thirds of nurses had experience from 3 to 6 years. This is contradicted with **Yoshida, Kosaka, Nishida, & Kumagai., (2008);** who found that majority of study sample have a diploma qualification, years of experiences in oncology units less than 20. **Saad (2002)** confirmed that, the

years of working experience are important in acquiring best practice and the experienced nurses had a significant level of performance than the less experienced nurses.

Findings of the current study revealed that, the majority of nurses have no previous training courses related to chemotherapy. This result was agreed with **Ahmed (2001)** who, clarified that the majority of nurses not received training courses about cancer and its treatment. Also **Yoshida, Kosaka, Nishida, & Kumagai., (2008)** noted that nurses had in-service training courses related to chemotherapy precautions. In this context, Finding in disagreement with **Gozzo, Santos & Cruz. (2017)** who observed that the participants were mostly nurses (62.5%), with previous training on the care that should be given to the individual undergoing chemotherapy (43.2%). In the same field and the contradiction results with the current study because the nurses included in the study are less than 5 years experience and have no training courses, **Roberts, (2003)** stated that, the nurses do chemotherapy administration received training and also supervised by a highly competent nurse during administration of chemotherapy.

As well, majority of the studied nurses were not worked in oncology places related to chemotherapy. This finding is supported with **Gibson et al, (2013)** emphasize that, several studies have shown that the nurses who trained about safety chemotherapy administration before starting to work in the field where they will administer chemotherapy is low, whereas most of them complete these trainings while working at the chemotherapy centers. But the present study goes in the opposite line with **Gozzo, Santos & Cruz.(2017)** who confirmed that the participants were specialization in the oncology area (50%), the contradiction between this result finding and the current study due to the nurses are included in the current study worked only in outpatient chemotherapy clinic.

Part II: Observational checklist for chemotherapy administration

In the lights of the present findings it was revealed that a statistically significant improvement in nurses' practices post program. This is in agreement with previous study **Mohamed, (2015)**, which reported that, a great improvement in the practice score levels obtained by nurses after the application of the designed nursing protocol. This has been concluded by the presence of significant difference between results of pre- program and post- program. This finding could indicate that practice must be easily improved, especially if linked with their relevant scientific base of knowledge. The overall finding of the study indicated that the participants have poor practice. This finding is important for nursing care to cancer patients because if oncology nurses did not have advance knowledge and not competent in their practices will be considered as unsafe for providing chemotherapy administration to cancer patients and chances for medication errors can be high as various studies in past already highlighted these points **Rinke et al (2007)**. Nurses' awareness and knowledge about the handling of cytotoxic drugs remains a concern linked to improvement in safety standards. The higher the nurses' knowledge the more they use the safety measures in their practices. Literature reports that there is a gap between the nurses' knowledge and their actual behavior with respect to the use of protective measures **Mohans., Wilkes., Ogunsiji., & Walkera. (2005)**.

These results may be attributed to the nurses become had adequate competent practice post program implementation about the rights methods for administration of chemotherapeutic agents and available booklets containing basic knowledge and principles as regards chemotherapy administration, its side effects, how to manage it, and potential complications of administering chemotherapy as well as they were skilled at performing immediate interventions.

Part III: Assessment of extravasation complications

Although interventions performed through venous catheterization in oncology clinics provide many advantages for the patient and health professionals, they may cause problems such as phlebitis, extravasation, thrombophlebitis, air embolism, circulatory overload, bleeding, hematoma, and infection, unless they are performed and monitored properly **Pérez et al (2012)**. In the same line with the current study findings which revealed that patients with no manifestation increased in post program and follow up while patients with immediate and delayed manifestation was decreased post program and at follow up phase regarding to all manifestations. But contradicted with **Gozzo, Santos & Cruz.(2017)** who identified that all participants showed pain with one of the signs and 93.7% indicated symptoms such as burning, erythema and edema, the difference between current study and the research finding related to nurses education and follow guidelines as well as patient symptom was decreased at post and follow up phase

Based on finding of the current study, the patient complications from extravasation were decreased after nurse's education. This finding in accordance with **Firas, et al, (2016)** who stated that, education of health team member about risks and manifestations are essential in Prevention of chemotherapy extravasation is an important quality indicator for certification of chemotherapy infusion centers and guidelines regarding extravasation prevention and management, there is a need to have local institution education, training and guidelines. All institutions that administer intravenous chemotherapy should have known antidotes available.

XI. CONCLUSION

As a result of educational program implementation, the studied nurses' practice regarding to administration of intravenous chemotherapeutic agent were improved and indicated a significant differences between scores pre/post implementation of educational program. In addition complications of chemotherapy extravasations were decreased after implementation of the program.

XII. RECOMMENDATIONS

- It is essential to all nurses who administer chemotherapeutic agents to participate in regular periodic in service training programs to keep them up to date regarding to safe and efficient administration of chemotherapeutic agents.
- Careful nursing assessment for patients before, during and after chemotherapy administration is a crucial component toward preventing chemotherapy extravasations.
- Orientation programs for newly enrolled nurses who work in oncology units is recommended.
- Replication of the study on a large population and in different geographic areas.

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