

Effect of Designing Nursing Training Program on Nurses to Minimize Patients' Complications of Chemotherapy Extravasation

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Abstract

Background: Extravasation is a severe complication during infusion of cytotoxic chemotherapy. **Aims** of this study are to assess nurse' knowledge and practice about chemotherapy extravasation, designing and implementing nursing training program and evaluate effect of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation. **Research design:** A quasi-experimental research design (Pre-post test) was used to conduct this study. **Setting:** Internal medical oncology departments and one day administration chemotherapy clinic at South Egypt Cancer Institute. **Sample:** A convenience sample including (40) nurses and (150) patients pre & (150) patients post implementation of designing nursing training program. **Tools:** Pre/post structured questionnaire for assessment nurses knowledge and observational checklist sheet for assessment nurses practice were used, designing nursing training program for minimizing complications of chemotherapy extravasation and pre/post Patient's assessment sheet to evaluate outcome of nursing training program. **Results:** The majority of studied nurses' ages were 20 to less than 40 years old and didn't attain any training program related chemotherapy extravasation, marked improvement in nurses' knowledge, practice post implementation of The designing nursing training program with statistically significant differences P. value <0.001**. **Conclusion:** The designing nursing training program had statistically significant improvement on nurses' knowledge, practice and minimized patients' complications of chemotherapy extravasation.

Keywords: Chemotherapy extravasation, Nursing training program & Patients' complications.

Introduction:

Cancer is a complicated illness that can be brought on by many things, like genetics and the environment. It is generally regarded as second-leading cause of mortality globally after heart disease. While radiation therapy, medical procedures, immunotherapy, endocrine treatment, and quality treatment are all forms of disease treatment, chemotherapy is still the most widely used method for eradicating malignant growth. (Bukowski et al., 2020)

In chemotherapy, antineoplastic medications are utilized to upset cancer cells processes by interfering with cellular function, like DNA repair and replication with an end goal to kill disease cells. Antineoplastic drugs can be used in combination with surgery, radiation therapy, or both to reduce the size of the tumor and eliminate any remaining tumor cells. At the point when infused, these medications either spill into the surrounding tissues cause extravasation at the infusion site. (Behranvand et al., 2022)

Extravasation might happen in light of several factors, and hazard associated with patient related factors, for example, age, fragile vein, overweight, lymphedema, peripheral vascular disease, diabetes mellitus and impaired sensory perception. As well as factors

related to devices and chemotherapy drugs, such as large gage catheters and metal needles and Health professional related factors like cannulation procedure, lack of experience, absence of information, lack of training, and nonadherence to the rules of chemotherapy organizations. (Kimmel et al., 2018)

Chemotherapy extravasation can result in a number of problems ranging from mild to severe. Including acute burning, pain, and swelling at the infusion site. The intensity of the symptoms varies according to the extent and concentration of the drugs that has been leakage. (Hassan & Hasary, 2022)

The basis of the safe administration of chemotherapy remains ongoing education and training for oncology nurses, which emphasises the significance of being proactive rather than reactive to side effects like extravasation. (Sharour, 2020)

Significance of the study:

From the researcher's clinical experience during 12 years was working period in oncology field revealed that chemotherapy extravasation can result in a variety of mild to severe issues; acute burning, pain, and swelling at the infusion site which lead to

necrosis. It has been noted that most of the nurses' knowledge and practice about chemotherapy extravasation are not adequate and nurses need to know more about chemotherapy extravasation, how preventing and managing it. So this study was the first study that provided a designing nursing training program on nurses to minimize patient' complications of chemotherapy extravasation in South Egypt Cancer Institute.

Aims of study: This study Aimed to Assess nurse' knowledge and practice about chemotherapy extravasation, designing and implementing nursing training program and evaluate effect of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation.

Hypothesis:

1. The mean knowledge and practice scores of the nurses will be improved post the implementation of the designing nursing training program.
2. Incidence of Patients' complications of chemotherapy extravasation will be minimizing after implementation of designing nursing training program.

Subjects and Method:

Research design: A quasi-experimental research design (pre-post test) was used to conduct this study.

Setting: The study was conducted at internal medical oncology department and one day administration chemotherapy clinic at South Egypt Cancer Institute.

Subjects: Convenience sample (40) nurses as (10) nurses working in one day administration chemotherapy clinic, (30) nurses working in internal medical oncology departments & (300) patients of both sex their ages ranged between 18-65 years old divided into two equal groups (150) patients pre and (150) patients post implementation of program selected by using the following equation according to Steven K. Thompson, 2012.

$$n = \frac{N \times p(1-p)}{\left[\left[N - 1 \times (d^2 \div z^2) \right] + p(1-p) \right]}$$

Study tools:

Tool (I) Pre/post questionnaire sheet for Nurses: It include 3 parts

- **Part (1) Demographic data for nurses;** to assess the demographic and personal data for the study sample that include 4 items as age, qualification, years of experience and attained program related to chemotherapy and it's extravasation.
- **Part (2) Assessment nurses' Knowledge regard chemotherapy extravasation;** it was established and collected by the researcher based on recent literature to assess nurses' level of knowledge pre and post implementation of designing nursing

training program, which include 3 main sections numbered as 14 questions; Section (1): Chemotherapy definition, uses. Section (2): Extravasation of chemotherapy definition, risk factors, clinical manifestation, complications and grades. And section (3): Immediate nursing management of intentionally extravasation of chemotherapy. These questions are developed according to the content of the designing nursing training program.

Scoring system: Total number of questions was 14; the total scores of nurses' knowledge questionnaire sheet were 50 degrees.

- Two definition (4 degree) each one had two degree for complete answer, one degree for incomplete and zero for didn't know.
- Eight enumerate questions each one had some points given one degree for each correct answer, half degree for in complete answer and zero for missed one/ didn't know in each question.
- Four questions (Yes/ No); one degree for correct answer and zero for didn't know. The total score of nurses' knowledge were ranged as
 - Less than 50% referred to poor level of knowledge.
 - 50:75% referred to fair average level of knowledge.
 - More than 75% referred to good level of knowledge.

▪ **Part (3) Observation checklist for nurses;** it was applicable by the researcher to evaluate the nurses' practice before and immediately after implementation of designing nursing training program. It was included 4 main items, adopted from (Olsen et al., 2019) & (Yoost & Crawford, 2019).

- A. Ensures that infection control is followed by (Hand washing); with soap and water included 6 items, or with alcohol swab included 2 items.
- B. Training on properly peripheral catheter insertion, included 30 items.
- C. Training on safe administration of anti-cancer drugs via intravenous cannula IVC. It was included 20 items.
- D. Extravasation- management standards, according to grade 1, 2 included 3 item for each and grade 3, 4 included 9 items for each.

Scoring system for Nurse's practice; the following scores were given to each item on the checklist: (Done correct = 2, done incorrect= 1 and not done= 0).

- Adequate level of nurses' practice was estimated to 80% and more.
- In adequate level of nurses' practice was from less than 80%.

Tool (II) Designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation; it was deliberate in writing Arabic language form by researcher based on the appraisal of relevant literatures and theoretical knowledge of various aspect of the study using books,

articles, periodicals and magazines. It includes two parts (knowledge and practice).

- **First part:** included knowledge about (definition and uses) of chemotherapy, (definition, risk factor, causes, signs and symptoms, grades, complications, knowledge of prevention and management) of chemotherapy extravasation.
- **Second part:** included nurses' practice for patient undergoing chemotherapy as provide general care as hand washing, training on properly peripheral catheter insertion (intravenous cannulation), training on safe administration of anti-cancer drugs via intravenous cannula (IVC) and extravasation management standards.

Tool (III) Pre/ post patient's assessment sheet to evaluate outcome of nursing training program; it includes two parts.

- **Part (1) Demographic data for patients;** it included (7) questions related to personal and demographic data for participated patients (Patient's age, medical diagnosis, gender, level of education, occupation, chronic illness/ past history and chemotherapy administration data.
- **Part (2) Assessment of signs and symptoms of complications chemotherapy extravasation.** According to National Cancer Institute Common Terminology Criteria for Adverse Events CTCAE, 2017.

Scoring system:

Common Terminology Criteria for Adverse Events shows Grades 1 through 5 with exceptional clinical representations of seriousness for each AE in light of this basic rule: Mild, 1st grade; absence of symptoms or mild symptoms; clinical or analytic perceptions as it were; Intervention is not necessary. Moderate in Grade 2; the need for minimal, local, or non-invasive treatment; limiting instrumental, age-appropriate activities of daily living. Grade 3: Serious or medically significant, but not life-threatening right away; indicated hospitalization or prolonged hospitalization; disabling; restricting self-care. Grade 4: Dangerous to one's life; It was necessary to act immediately. Death in Grade 5.

NCI (CTCAE) V. 5.0 infusion site extravasation

- Grade 1: Painless edema.
- Grade 2: Erythema joined by edema, pain, enlarging, and phlebitis.
- Grade 3: Ulceration or decay, serious tissue hurt; needed surgical intervention.
- Grade 4: life threatening; urgent intervention indicated.
- Grade 5: Death.

Procedure:

There were three phases to the study: the preparatory phase, the implementation phase, and the evaluation phase.

Phase (1): The Preparatory phase

- The researcher presented herself to the oncology unit's available nurses, described the purpose of the study and obtained their verbal consent before setting up the design of nursing training program.
- Following a thorough examination of the literature (nursing text books, journals, and online resources) on chemotherapy extravasation and an evaluation of nurses' knowledge and practice in this area, the researcher created and evaluated a nursing training program.

Content validity and reliability:

- Official approval and administration permission were obtained from the head of the selected department (medical oncology department) then the study and program was carried out.
- The tools were tested for content validity by panel of five expertises (3 teaching staff of Medical Surgical Nursing, Faculty of Nursing and 2 Lecturer of Medical Oncology in South Egypt Cancer Institute). Who reviewed the tools for clarity, significance, comprehensiveness, accepting, applicability and easiness, minor modifications were required.
- Reliability of the tools was measured by Cronbach's alpha coefficient test.
- Pilot study; the purpose of this study was of 2 reasons: first, to ensure the simplicity of designated study tools. Second, to examine the usefulness of the designed tools and solve any difficulties or problems needed to be handled before applying it. Adjustment of the sheet and checklist was done to advance the final form that is the most suitable. (Four) nurses and (fifteen) patients; those nurses / patients who were involved in the pilot study were calculated (10%) from actual study sample.

Phase (2) Implementation phase:

- The researcher was interviewing the nurses in groups/ patients individually to collect the necessary data.
- Numbers of nurses involved were 40 nurses divided into 8 groups, time availability four times weekly, shifts determined at morning as well as the resources available. Number of session totally 7 sessions would be conducted for each group. The data collection period was done with in 3 months from the start of October to the end of December, 2022.
- The questionnaire sheets were administered by the researcher to all nurses to assess nurses' knowledge and practice using (Tool I, part 2) and performance checklist (tool I, part 3) pre-program. Time needed for completion of questionnaire sheets by nurses was between 20- 30 minutes.
- Implementation of the designing nursing training program on nurses to minimize patients'

complications of chemotherapy extravasation (tool II) need from researcher prepared the training place, teaching aids and media (modified Arabic handouts, pictures and videotapes). It was followed by arranging for the nursing training program schedule based on the contents of the program.

Theoretical part: Three sessions; duration each session about 20- 30 minutes according to nurses' acceptance.

- **The first session;** it was included knowledge about chemotherapy definition, uses, definition of chemotherapy extravasation, common causes and different risk factors for chemotherapy extravasation.
- **The second session;** it was contained information about signs and symptoms and differentiate between grades of chemotherapy extravasation and expected complication.
- **The third session;** which included prevention, management standard of chemotherapy extravasation and patient education.

Practical part: it was including 4 sessions; duration of these last four sessions about 30- 45 minutes for each.

- **The fourth session;** it was contained training on probably hand washing.
- **The fifth session;** Then training on properly peripheral catheter insertion.
- **The Sixth session;** it was included training on safe administration of anti-cancer drugs (chemotherapy agent) via intravenous cannula (IVC).

- **The seventh session;** it included extravasation-management standards.

Phase (3) Evaluation phase:

This phase was doing immediately by the end of the program implementation. Evaluate the outcome of designing nursing training program on nurses and patients through a comparison between pre and post test using tool I part 2, 3 and tool III.

Ethical consideration

The nursing faculty's ethics committee authorized the research idea. The study subjects are not at any risk when the research is being used. The study adhered to accepted ethical standards for clinical research. After describing the study's nature and objectives, nurses and patients who were willing to participate in it verbally consented. Anonymity and confidentiality were guaranteed. Subjects are free to decline participation in the study at any time and without giving a reason. During data collecting, privacy was taken into account.

Statistical design

Descriptive and inferential statistics were employed to collect and evaluate the data using the computer system SPSS. Supplied with information in the form of "number, percentage," "mean standard deviation," etc. The results of the T-test are used to establish the significance of a numerical variable. Additionally, for numerical variables within the same group, we employed individual correlation.

Results:

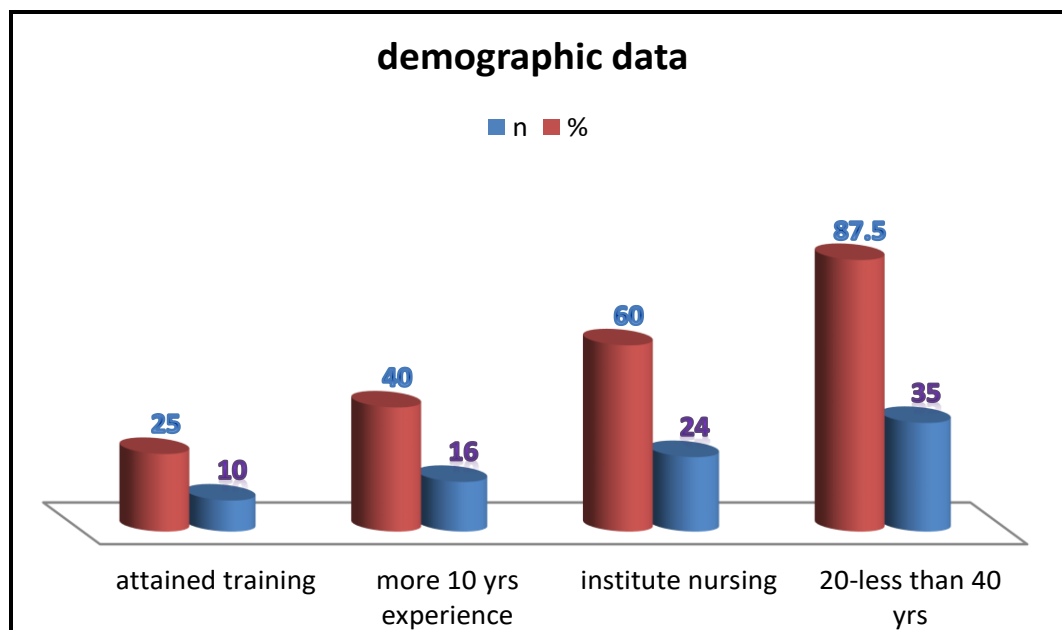


Figure (1): Percentage distribution of demographic data for nurses (n= 40)

Table (1): Comparison between nurses' knowledge pre/ post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation (n=40).

Question	Answer	Pre program		Post program		p. value
		n	%	n	%	
Q1:Define of chemotherapy	Correct	34	85	40	100	0.01*
	Incomplete	6	15	-	-	
Q2:Uses of chemotherapy	Correct	23	57.5	40	100	0.001**
	Incomplete	17	42.5	-	-	
Q3:Effect of chemotherapy when extravasated outer the vein	Correct	33	82.5	40	100	0.001**
	Incomplete	7	17.5	-	-	
Q4:What's meant by extravasation	Correct	24	60	40	100	0.001**
	Incomplete	16	40	-	-	
Q5:Patients risk factors related extravasation	Correct	5	12.5	40	100	0.001**
	Incomplete	35	87.5	-	-	
Q6:Medication risk factor related extravasation	Correct	3	7.5	40	100	0.001**
	Incomplete	37	92.5	-	-	
Q7:extravasation risk factors related cannula devise	Correct	6	15	40	100	0.001**
	Incomplete	34	85	-	-	
Q8:extravasation risk factors related to health care team	Correct	20	50	40	100	0.001**
	Incomplete	20	50	-	-	
Q9: Sign & Symptoms of Extravasation	Correct	4	10	40	100	0.001**
	Incomplete	36	90	-	-	
Q10: Nursing management of extravasation	Correct	-	-	40	100	0.001**
	Incomplete	40	100	-	-	
Q11: Complications of chemotherapy	Correct	4	10	40	100	0.001**
	Incomplete	36	90	-	-	
Q12: Is there recover from extravasation	No	4	10	-	-	0.058*
	yes	36	90	40	100	
Q13: do you know grades of extravasation	No	25	62.5	-	-	0.001**
	yes	15	37.5	40	100	
Q14: do you know nursing management related each grades	No	20	50	-	-	0.001**
	yes	20	50	40	100	

Table (2): Comparison between nurses' practice (observation checklist) pre/ post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation (n=40).

Items	Pre implement designing nursing training program					Post implement designing nursing training program					P. value		
	Done				N.D	Done				N.D			
	C		I			C		I					
	n	%	n	%	n	%	n	%	n	%			
1- Properly Hand washing (General care)													
Soap & water	2	5	36	90	2	5.0	39	97.5	1	2.5	-	-	0.001**
Alcohol swab	34	85	5	12.5	1	2.5	40	100	0	0	0	0	0.039*
2- Peripheral Catheter Insertion													
Sub steps	17	42.5	4	10.0	19	47.5	40	100.0	0	0	0	0	0.001**
3- Safe administration of anti-cancer drugs via (intravenous cannula IVC)													
General procedure	8	20	9	22.5	23	57.5	40	100	0	0	0	0	0.001**
a. Vesicant drugs	9	22.5	5	12.5	26	65	40	100	0	0	0	0	0.001**
b. Drugs via bolus injection	32	80	3	7.5	5	12.5	40	100	0	0	0	0	0.122
c. Drugs via IV infusion	8	20	2	5	30	75	40	100	0	0	0	0	0.001**
Procedure ending	11	27.5	8	20.0	21	52.5	40	100.0	0	0	0	0	0.001**
Total safe administration	14	35.0	5	12.5	21	52.5	40	100.0	0	0	0	0	0.001**

Figure (2, 3): Comparison between nurses 'practice regarded extravasation management standards according each extravasation grade pre/ post implementation of designing nursing training program.(n= 40)

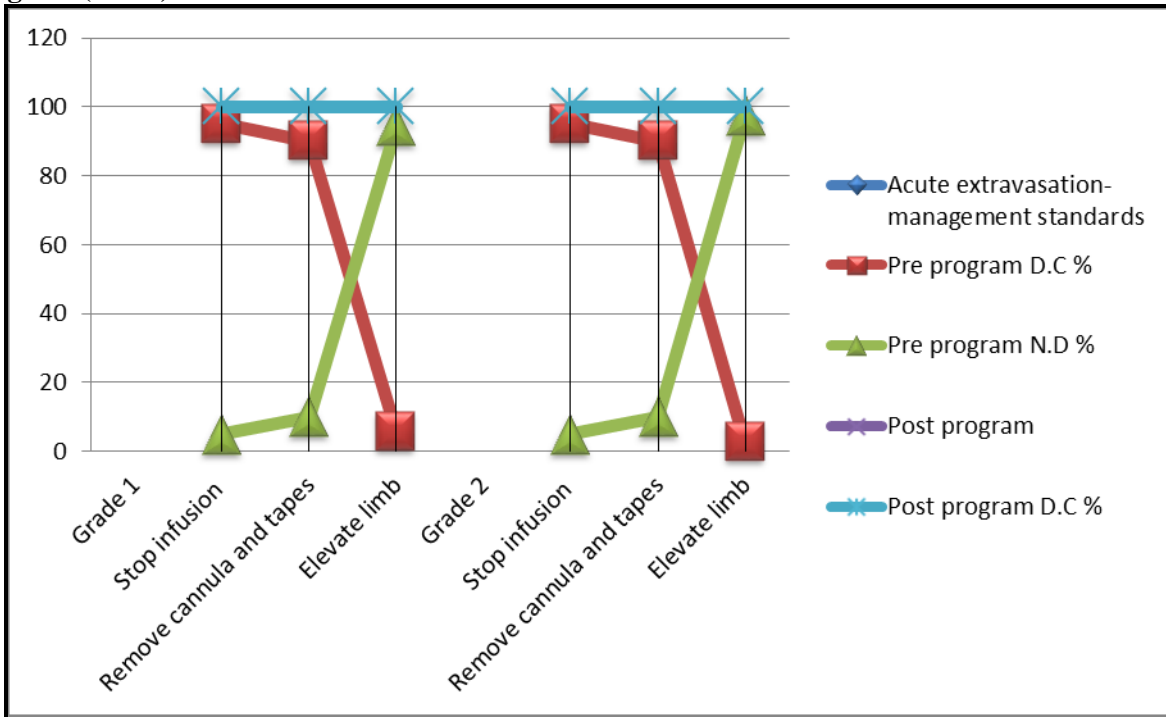


Figure (2): Comparison between nurses 'practice regarded extravasation management standards (grade 1& grade 2)

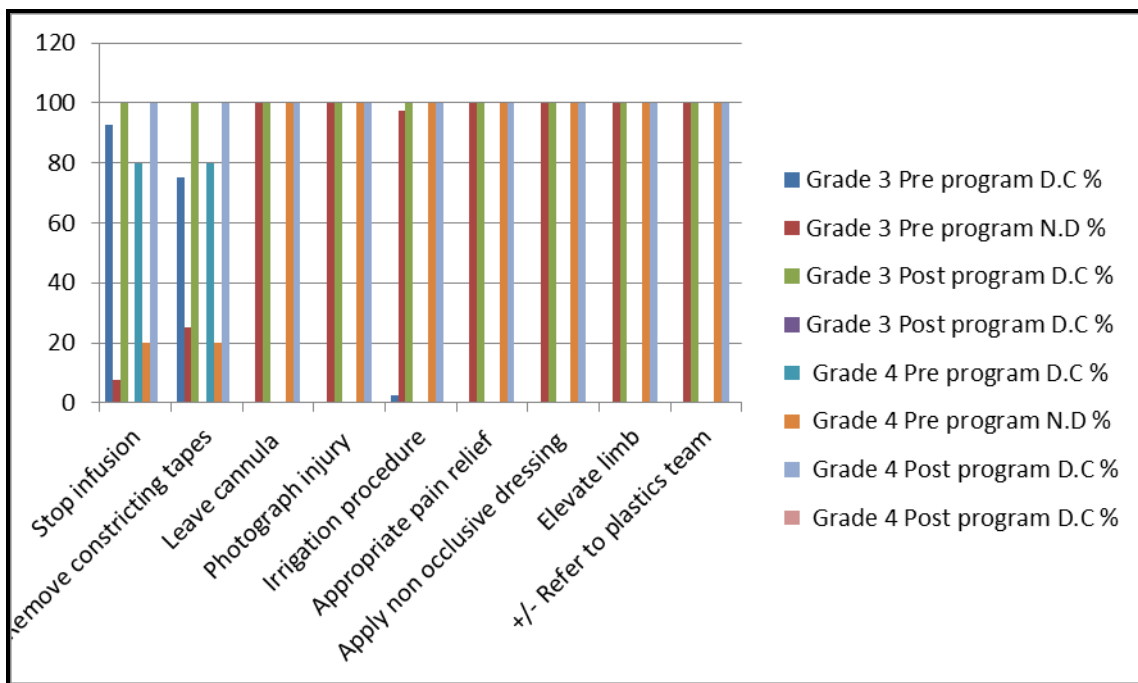


Figure (3): Comparison between nurses 'practice regarded extravasation management standards (grade 3& grade 4)

Table (3): Distribution of demographic data for studied patients (n=150).

Demographic data	Pre		Post	
	(n=150)	%	(n=150)	%
Age				
18> 40	61	40.7	65	43.3
40 – 65	89	59.3	85	56.6
Sex				
Male	50	33.3	55	36.6
Female	100	66.6	95	63.3
Level of education				
Illiterate	30	20.0	28	18.6
Read and write	10	6.7	12	8
Basic education	17	11.3	19	12.6
Secondary education	82	54.7	81	54
University education	11	7.3	10	6.6
Occupation				
Office work	8	5.3	7	4.6
Machinery work	1	0.7	3	2
Manual worker	24	16.0	30	20
Not working	117	78.0	110	73.3
Diabetes mellitus				
Yes	36	24.0	43	28.6
No	114	76.0	107	71.3
Cardiovascular disease				
Yes	6	4	10	6.6
No	144	96.0	140	93.3
Hypertension				
Yes	19	12.6	22	14.6
No	131	87.3	128	85.3
Hypotension				
Yes	1	0.7	3	2
No	149	99.3	147	98
Obese				
Yes	52	34.6	60	40
No	98	65.3	90	60

Table (4): Comparison between nursing interventions related chemotherapy extravasation pre/ post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation

Items	Pre				Post				p.v
	Yes		No		Yes		No		
	n	%	n	%	n	%	n	%	
Immediate actions									P<
Stop injection / infusion immediately	30	100	0	0	12	100	0	0	0.0001
Leave VAD in situ	0	0	30	100	12	100	0	0	< 0.0001
Aspirate residual drug from VAD with syringe	0	0	30	100	12	100	0	0	< 0.0001
Secondary actions	30	100	0	0	12	100	0	0	< 0.0001
Treating team notified									
Photo taken	0	0	30	100	16.6	2	83.3	10	< 0.0001
Affected area outlined with marker	0	0	30	100	12	100	0	0	< 0.0001
Warm compress	0	0	30	100	4	33.3	8	66.6	< 0.0001
Cold compress	0	0	30	100	8	66.6	4	33.3	< 0.0001
Antidote	0	0	30	100	8	66.6	4	33.3	< 0.0001
Analgesia	0	0	30	100	11	91.6	1	8.3	< 0.0001

Table (5): Comparison between complications of chemotherapy extravasation pre/ post implementation of designing nursing training program

CTCAE (Infusion site extravasation) Grades	Pre program		Post program	
	n	%	n	%
Grade 1 Painless edema				
Grade 2 Erythema with associated symptoms(e.g; edema, pain, induration, phlebitis)			12	8
Grade 3 Ulceration or necrosis; sever tissue damage; operative intervention indicated	30	20		
Grade 4 Life- threatening consequances; urgent intervention indicated				
Grade 5 Death				

Common Terminology Criteria for Adverse Events (CTCAE) v5.0 (2017)

Table (6): Comparison between numbers and percentage of incidence of Patient’s extravasation sign pre/ post implementation of designing nursing training program (n=150)

Patient’s extravasation sign	Pre		Post		p.v1	p.v2
	N	%	N	%		
No extravasation sign	120	80	138	92	0.001**	0.0001***
Extravasation sign	30	20	12	8		

Figure (1): Illustrated that; the majority of studied nurses' ages were 20> 40 years old (87.5 %), more than half of studied nurses had institute of nursing as regard to level of education (60.0%) and the majority of sample didn't attain any training program related chemotherapy extravasation (75.0%) although most common years of experience were more 10 years in oncology field.

Table (1): Showed that; there were statistical significant differences in nurses' knowledge in all items between studied nurses pre/ post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation.

Table (2) & Figure (2,3): Represented that; there were statistical significant differences between nurses' practice in all items pre and post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation.

Table (3): Showed that; more than half of studied patient' ages were 40 > 65 years (59.3) %, the majority of patients were females (66.6%) and not working (78.0%). As regard to level of education more than half were educated with secondary school level (54.7%). Less than one third of patients were having diabetes mellitus (24) %, cardiovascular disease (4) %, Hypertension (12.6) %, hypotension (0.7) % and (34.6) % were obese.

Table (4): Showed that; there were statistical significant differences between nursing interventions related chemotherapy extravasation pre/ post implementation of designing nursing training program.

Table (5): Showed that; pre implementation of the designing nursing training program (20) % from total number of patients had extravasation within grade (3) Ulceration or necrosis; sever tissue damage, while post implementation of the designing nursing training program the percentage of extravasation in between studied patients decreased to (8) % from total numbers of studied patients within grade (2) which had erythema (edema, pain, induration, phlebitis).

Table (6): Represents that there were highly significant differences between numbers and percent of incidence of cases complain from extravasation pre/ post implementation of designing nursing training program. This study indicates that in general, 150 patients underwent different cycle of chemotherapy; most of them did not experience extravasation, namely 80.0% (120 patients) pre program and 20.0% (30 patients) complain extravasation of chemotherapy. While post program the extravasation incidence decreased to 8.0%.

Discussion:

Extravasation rate brought on by different protocols of cytotoxic medicines ranges from 0.1% to 6% that can cause serious morbidities such pain and decreased

movement in addition to long-term harm to tendons, soft tissues, and nerves. Extremity amputation, tissue debridement or grafting may be necessary in the event of significant extravasation. In adults, extravasation damage occurs at different rates depending on the patient and medicine. (Atay et al., 2021)

Depending on the result of the current study, the majority of studied nurses' ages were 20 to less than 40 years old, more than half of studied nurses had institute of nursing as regard to level of education and they didn't attain any training program related chemotherapy extravasation although most of them had experience in medical oncology more 10 years in oncology field.

This result is in agreement with (Prakash et al., 2022), who demonstrated that half of the thirty participants were aged 31 to 40. In terms of gender, two thirds of the subjects were female. The Post Basic Science of Nursing (P.B.Sc.) program had been completed by one third, and less than 33% of them had a Four year education in science in Nursing (B.Sc. N.). In total, more than a third of the subjects had worked for more than ten years. Regarding the management of extravasation of chemotherapeutic drugs, none of the subjects had participated in the Continue Nursing Education program.

In the lights of the present findings of this study in South Egypt Cancer Institute illustrated that; there were statistical significant differences in nurses' knowledge in all items pre/ post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation. Agree with the viewpoint of (Hassan & Hasary, 2022) who noted that the provision of current institutional policies and practical training procedures ensures that all members of the health team receive consistent training and knowledge regarding chemotherapy administration this is accomplished in order to achieve effective prevention of chemotherapy-induced extravasation.

In the present study we strongly mentioned that; there were statistical significant differences between nurses' practice in all items pre and post implementation of designing nursing training program on nurses to minimize patients' complications of chemotherapy extravasation, as regarding Properly Peripheral Catheter Insertion (intravenous cannulation), Safe administration of anti-cancer drugs via (intravenous cannula IVC) and extravasation management standards for different extravasation grades.

This study, which is in agreement with (Sharour, 2020) found that all nurses received training in cannulation and assessment during their undergraduate studies, but that their knowledge of cannula characteristics and the site of insertion to prevent extravasation was limited because they did

not receive any training in this area. It also found that the participants' knowledge of recent evidence-based management practice for extravasation was very limited, especially in relation to specific treatment and general measures elements. The kind of chemotherapy should determine the exact extravasation intervention, according to ESMO-EONS recommendations. The lack of information nurses had about these evidence-based therapies suggested that their knowledge was stale and needed to be updated.

From researcher opinion, these results highlighted the importance of continue education in improving nurses' knowledge and strengthening their competencies. In the present study, we focus to provide huge amount of knowledge and teaching/training oncology nurses on evidence-based interventions skills needed to prepare qualified nurses able to provide safe adjustment about ideal cannulation insertion, correctly administration of vesicant, irritant chemotherapy infusion and acute nursing management standards of extravasation according to grades of severity.

This study revealed that; more than half of studied medical oncology patient' ages undergoing different protocol of chemotherapy were 40 to less than 65 years, the majority of studied patients were females and not working As regard to level of education more than half were educated with secondary school level. Less than one third of patients were having diabetes mellitus, and more than one third were obese. This was agree with study conducted by (Abd El-Salaheen et al., 2022) who illustrated that, more than half of the studied patients were females and there age ranged between 41-50 years respectively. While half of them cannot read or write and married.

The current study represented that; there were statistical significant difference between nursing interventions related chemotherapy extravasation pre/ post implementation of designing nursing training program. This result was in agreement with (El-Fadl, 2020) who reported statistically significant differences in the studied nurses' practice pre, immediately, and after three months from program implementation about nurses' practice regarding preventive strategies and extravasation management.

We concluded that the studied nurses after implementation of designing nursing training program gained new knowledge and skills enabled them to be competent during their practice.

Current study finding showed that; pre implementation of the designed nursing training program twenty percent from total number of studied patients had extravasation within grade (3) which had Ulceration or necrosis; sever tissue damage; operative intervention indicated, while post implementation of

the designing nursing training program the percentage of extravasation in between studied patients decreased to eight percent from total numbers of studied patients within grade (2) which had erythema with associated symptoms (edema, pain, induration, phlebitis).

This in the same line with (Abd El-Salaheen et al., 2018) who demonstrated that there is a strong association between the level of nurses' performance and the incidence of extravasations; the higher the nurses' performance, the lower the incidence of extravasations, indicating that extravasations are strongly associated with low nurses' performance.

This study's findings are consistent with those of (Pluschnig et al., 2015) who identified inadequate staff training, improper cannula insertion technique, and chemotherapy delivery as frequent risk factors associated to nurses' performance. The risk of extravasation may also be increased by iatrogenic factors such improper puncture technique or improper installation of indwelling cannulas, particularly by inexperienced workers.

From our clinical field we conclude that, unfavorable environmental conditions, heavy workload, decreased patients-to-nurses ratio and absence of training programs considered main factor which decrease nurses' performance.

Study finding refer to highly significant differences between numbers and percent of cases complain from extravasation pre/ post implementation of designing nursing training program. This matched with (Ammar et al., 2019) who found that the patient complications from extravasation were decreased after nurse's education. Also, 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.

Conclusion:

The designing nursing training program had statistically significant improvement on nurses' knowledge and practice. After implementation of designing nursing training program on nurses minimize patients' complications of chemotherapy extravasation.

Recommendations:

- The medical oncology department should be well organized with in South Egypt Cancer Institute and

equipped with the best educational facilities to advance knowledge and practical skills of healthcare providers, which will improve patient outcomes.

- Restricted policy as regard chemotherapy extravasation prevention, immediately and secondary management should be announced to all health provider in South Egypt Cancer Institute.

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