

## Enhancement of Oncology Nurses' Competency Regarding Management of Intravenous Chemotherapy Extravasation

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### 1.ABSTRACT

**Background:** Chemotherapy extravasation is serious problem, causing a damage that may range from a minor skin reaction to full-thickness burn, muscle, tendon necrosis and results in extending hospital stays, increasing morbidity, and treatment costs. **Aim:** Enhance oncology nurses' competency regarding management of intravenous chemotherapy extravasation. **Method:** A quasi-experimental design one-group pretest posttest was used with a sample of 63 nurses working at the medical department and chemotherapy installation unit at Oncology Center at Mansoura University Hospital. **Tools:** Two tools were used: Tool 1: Structured Interview questionnaire. Tool 2: Nurses' practice observational checklist. **Results:** Nurses' knowledge levels improved regarding chemotherapy extravasation post educational intervention (80.7%) compared to (7%) pre educational intervention (P value <0.001\*). Nurses' practice levels improved post educational intervention (86%) compared to (50.9%) pre educational intervention (P value <0.001\*). **Conclusion:** There was statistically significant improvement in nurses' competency regarding chemotherapy extravasation post educational intervention. **Recommendation:** Continuous in-service training programs for oncology nurses regarding prevention and management of intravenous chemotherapy extravasation to improve their knowledge and practice.

**Keywords:** Chemotherapy, Extravasation, Management, Nurses, Prevention.

### 2.Introduction

Chemotherapy considers the most common treatment modalities of cancer. It can be used by different methods. Intravenous chemotherapy considers the most common administration route. It can cause different side effects as phlebitis, hypersensitivity, infiltration, and extravasation (Bukowski, Kciuk, & Kontek, 2020). Chemotherapy extravasation is defined as the unintentional leakage of chemotherapeutic agents from the vein into surrounding tissues (Hussin, & Ahmed, 2020). It can cause pain, erythema, edema, burning, blister, and discomfort at the intravenous injection site (Taibi et al., 2020).

Extravasation may result in severe ulcer and necrosis of the thorax, ligaments, subcutaneous tissue, skin, and peripheral vascular system. It may lead to life-threatening problems as lifelong deformity, permanent functional limitations, amputation of the affected extremity and significantly influence patient's quality of life

(Haynes, & Ortega-Loayza, 2020). The incidence of extravasation ranges from 0.01% to 7% through peripheral venous access and from 0.26% to 4.7% through a central venous access (Hassan, & Hasary, 2022).

Oncology nurses are responsible for safe and efficient intravenous chemotherapy administration to prevent chemotherapy extravasation. They should have knowledge about extravasation risk factors, manifestation, prevention, and treatment. Nurses must follow guidelines and competences regarding chemotherapy administration such as understanding types and categories of chemotherapy as vesicant, irritant, and non-vesicant drugs to maintain patient safety and prevent extravasation (Alkhalaf, & Wazqar, 2022). Furthermore, early detection and preventing are an important role to prevent complication as extravasation. Therefore, it is very important for nurse to be competent in preventing and

management of intravenous chemotherapy extravasation (Melo et al., 2020).

### **2.1 Aim of the study**

Enhance oncology nurses' competency regarding management of intravenous chemotherapy extravasation.

### **2.2 Research hypothesis:**

H1: Oncology nurses' knowledge regarding management of intravenous chemotherapy extravasation will be improved after implementation of enhancement program.

H2: Oncology nurses' practice regarding management of intravenous chemotherapy extravasation will be improved after implementation of enhancement program.

### **3. Methods:**

#### **3.1 Research design:**

A quasi-experimental design one-group pretest posttest was used.

#### **3.2 Research setting:**

This study was conducted at the medical department and chemotherapy installation unit at Oncology Center affiliated to Mansoura University Hospital.

#### **3.3 Research subjects:**

A convenient sample of all available nurses (63) providing direct care for cancer patients were included in present study.

#### **3.4 Tools of data collection:**

Two tools were used to collect data pertinent to this study.

##### **Tool 1 : Structured Interview questionnaire :**

This tool was developed by the researcher after reviewing recent related literature. which divided into two parts:

##### **Part 1: Nurses' Demographic Data:**

This part was used to address the personal data of the nurses and consisted of 6 items (age, gender, level of education, years of experience at the oncology center, years of experience of dealing with chemotherapy and attendance of training programs regarding chemotherapy extravasation.

##### **Part 2: Nurses' Knowledge Regarding Chemotherapy Extravasation:**

This part of tool was adapted from (Binner, Ross, & Browner, 2011 ; El-Fadl, 2020 ; Fidalgo et al., 2012). It was used to assess nurses' knowledge regarding chemotherapy and extravasation pre-test. It composed of 57 questions ; 32 true / false format and 25 MCQ questions. Nurses' knowledge regarding chemotherapy composed of

12 questions; 8 true / false format related to definition, aim, purpose, side effect, administration route of chemotherapy and 4 MCQ questions related to complications associated with intravenous chemotherapy and classification of chemotherapy drugs according to their ability to cause local damage after extravasation. Nurses' knowledge regarding extravasation composed of 45 questions ; 24 true / false format related to definition, causes, clinical manifestation, patients, chemotherapy, equipment, nurses related risk factors, and prevention of extravasation and 21 MCQ questions related to clinical manifestation, risk factors and management of chemotherapy extravasations.

##### **Scoring system:**

The correct answer was scored (1), the incorrect answer, and not known or no answer was scored (0). Total knowledge score level was converted into percentage and categorizes into:  $\geq 70\%$  (answered  $\geq 40$  questions) considered satisfactory level of knowledge.  $< 70\%$  (answered  $< 40$  questions ) was considered as an unsatisfactory level of knowledge (El-Fadl, 2020).

##### **Tool 2: Nurses' Practice Observational Checklist.**

This tool was developed by the researcher after reviewing recent related literature (Al-Naeli, & Hassan, 2021 ; Beaver, 2018 ; El-Hamed, Mahmoud, Bahgat, Marie, & El Sayed, 2017) to assess nurses' practice level regarding prevention and management of chemotherapy extravasation. It was checked by researcher as done and not done pre-posttest. It consisted of 3 main items and each item divided into sub items, before chemotherapy administration (21 sub items), during chemotherapy administration (6 sub items) ,and after chemotherapy administration (8 sub items).

##### **Scoring system:**

Done answer was scored (1) and not done answer was scored (0 ). Total practice score converted into percentage and categorized into: -  $\geq 75\%$  ( $\geq 26$  sub items) considered an adequate level of practice. -  $< 75\%$  ( $< 26$  sub items ) was considered as an inadequate level of practice (El-Fadl, 2020).

##### **3.5 Validity of the tool :**

Data collection tools were tested for validity by five experts in medical-surgical nursing in Faculty of Nursing at Mansoura University. Their opinions were given regarding tools format, appropriateness, relevance, comprehensiveness, clearance and competence. The necessary modifications were done accordingly.

### 3.6 Reliability:

Both tools were tested for reliability using Cronbach's alpha test which showed satisfactory level of reliability (0.759, and 0.916) respectively.

### 3.7A pilot study:

The Pilot study was conducted on 10% of studied nurses (6 nurses) who were excluded from the actual study. It was done to ascertain the relevance, clarity & applicability of the developed tool and to estimate the time needed to fill the questionnaire sheet. Each sheet lasted about 15-20 minutes to be filled.

### 3.8 Administrative preparations:

- Ethical approval was obtained from the Faculty of Nursing, Mansoura University Research Scientific Ethical Committee.
- An official written permission to carry out the study was obtained from the director of the oncology center at Mansoura University Hospital.
- After obtaining permission from the director of the oncology center at Mansoura University Hospital, the researcher met the head nurse of medical department and chemotherapy installation unit.
- Tool 1 part 1 was developed by the researcher . Part 2 was adapted from (Binner, Ross, & Browner, 2011; El-Fadl, 2020; Fidalgo et al., 2012).
- Tool 2 was developed by the researcher based on a review of recent related literature.
- Coloured booklet with simple Arabic language was developed by the researcher after reviewing recent related literature.

**3.9 Data collected** from the beginning of July till October 2022 the researcher used to go to the medical department and chemotherapy installation unit 8 hours/ day, 3 days/week.

### 3.10 Fieldwork

The framework of this study was carried out according to three phases: **assessment, implementation, and evaluation phase.**

#### Phase 1: Assessment phase:

- It began with introducing myself to participants and oriented them about study's aim and sessions.
- Researcher assessed oncology nurses regarding knowledge and practice regarding management of chemotherapy extravasation using the tool 1 and 2 as pre-test.

#### Phase 2: Implementation phase:

- This phase was started with implementation the educational intervention in form of two educational sessions as following :
- The first session covered definition, aim, purpose, side effect, administration route of chemotherapy, complications associated with intravenous chemotherapy, classification of chemotherapy drugs according to their ability to cause local damage after extravasation, definition , clinical manifestation, patients' related risk factors, chemotherapy related risk factors, equipment related risk factor , nurses related risk factors ,prevention, and management of chemotherapy extravasation.
- The second session covered specific measures that the nurse should follow to prevent and manage the risk of chemotherapy extravasation.
- The researcher interviewed with each nurse individually according to staff distribution schedule.
- Each session was last about 30-45 minutes, including periods of discussion according to the nurses' progress and feedback
- Different teaching tools and media used such as group discussions, oral presentations, and videos.
- Arabic coloured booklet regarding guidelines for prevention and management of chemotherapy extravasation was distributed for nurses.

#### Phase 3: Evaluation phase:

- This phase evaluated the effectiveness of educational intervention on studied nurses' knowledge and practice regarding management of intravenous chemotherapy extravasation as post-test.

### 3.11 Ethical Considerations

An Ethical approval was obtained from the Research Scientific Ethical Committee of the Faculty of Nursing-Mansoura University. All relevant possible aspects were considered. Informed oral consent was obtained from each nurse enrolled in the study after providing comprehensive information about the nature and aim of the study. The researcher emphasized that participation was voluntary. Participants informed that they had the right to refuse to participate in the study, withdrawn at any time, and the refusal to participate in the study was not effect on their

work. Anonymity, privacy, safety, and confidentiality assured throughout the whole study.

**3.12 Statistical Analysis:**

All statistical tests were conducted using SPSS for windows version 25.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in frequency and percentage. The comparisons were determined using Paired t test for two variables with continuous data, Chi-square test was used for comparison of variables with categorical data. Pearson correlation analysis was used for assessment of the inter-relationships among quantitative variables. To identify the independent predictors of the nurses' knowledge & performance multiple linear regression analysis was used after testing for normal distribution, normality, statistical significance was set at p<0.05.

**4. Results:**

**Table 1** shows demographic characteristics of the studied nurses. In relation to gender, it was noticed that most nurses (84. 2%) were women. Regarding to age, three quarter (75.4%) of the studied nurses ranged from 20 to less than 30 years

old. Concerning the level of education, more than two thirds of the studied nurses (66.7%) had nursing technician education. As regards years of experience, the results revealed that slightly more than two fifths of the studied nurses (42.1%) had experience at oncology center ranged from 5 to less than 10 years.

**Table 2** reveals nurses' knowledge levels regarding chemotherapy extravasation pre and post educational intervention. There was statistically significant improvement in nurses' knowledge levels regarding chemotherapy extravasation post educational intervention (80.7%) compared to (7%) pre educational intervention. There was highly statistically significant difference in nurses' knowledge levels post educational intervention (P value <0.001\*).

**Figure 1** illustrates that there was highly statistically significant improvement in nurses' practice levels post educational intervention.

**Table 3** shows that there was positive statistically significant correlation between knowledge and practice of the studied nurses regarding chemotherapy extravasation pre and post educational intervention

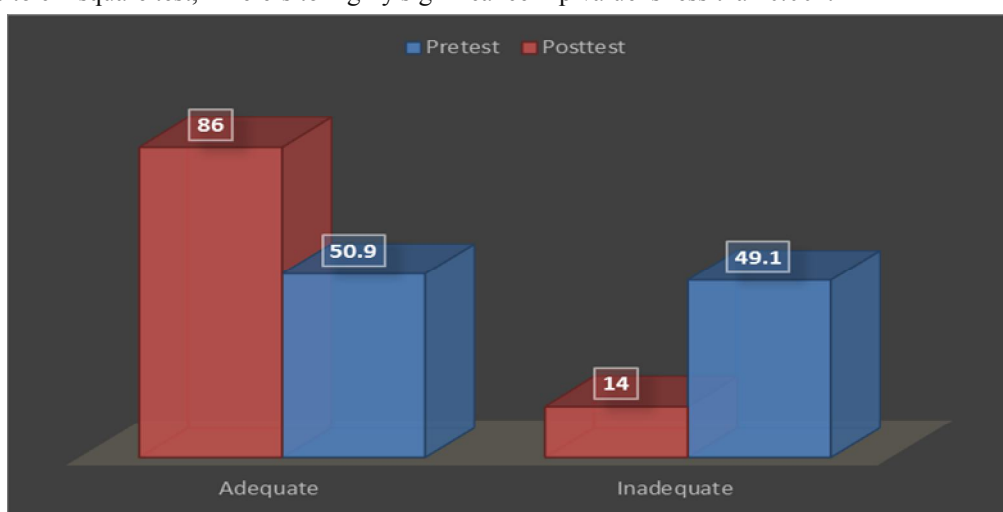
**Table 1:** Demographic characteristics of the studied nurses (N=57).

Items	No	%
<b>Gender</b>		
▪ Men	9	15.8
▪ Women	48	84.2
<b>Age (years)</b>		
▪ 20: < 30	43	75.4
▪ 30 : < 40	14	24.6
Mean age ± SD	27.44 ± 3.428	
Min.	22	
Max.	34	
<b>Educational level</b>		
▪ Nursing diploma	11	19.3
▪ Nursing technician	38	66.7
▪ Nursing bachelor	8	14
<b>Years of experience (years)</b>		
▪ < 1	2	3.5
▪ 1: < 5	17	29.8
▪ 5: < 10	24	42.1
▪ ≥ 10	14	24.6

**Table 2:** Nurses' knowledge levels regarding chemotherapy extravasation pre and post educational intervention (N=57).

Domains	Pretest				Posttest				Significance
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		
	No	%	No	%	No	%	No	%	
<b>Chemotherapy overview</b>	57	100	0	0	4	7	53	93	$X^2=99.049, p=0.000^{**}$
<b>Extravasation overview</b>	41	71.9	16	28.1	3	5.3	54	94.7	$X^2=53.447, p=0.000^{**}$
<b>Risk factors</b>	57	100	0	0	4	7	53	93	$X^2=99.049, p=0.000^{**}$
<b>Manifestations</b>	38	66.7	19	33.3	1	1.8	56	98.2	$X^2=53.356, p=0.000^{**}$
<b>Prevention</b>	49	86	8	14	3	5.3	54	94.7	$X^2=74.821, p=0.000^{**}$
<b>Management</b>	57	100	0	0	8	14	49	86	$X^2=85.938, p=0.000^{**}$
<b>Total knowledge</b>	53	93	4	7	11	19.3	46	80.7	$X^2=62.482, p=0.000^{**}$

$X^2$  refers to chi square test,  $^{**}$  refers to highly significance if p value is less than 0.001.



**Figure 1:** Nurses' practice levels regarding chemotherapy extravasation pre and post educational intervention.

**Table 3:** Correlation between knowledge and practice of the studied nurses regarding chemotherapy extravasation pre and post educational intervention (N=57).

Variable	r	P
Nurses' knowledge & practice (Pretest)	0.375	0.004*
Nurses' knowledge & practice (Posttest)	0.332	0.012*

r=refers to Pearson correlation, \* refers to significance if p value is less than 0.001

**5. Discussion:**

Chemotherapy extravasation refers to the inadvertent leakage of chemotherapy into the subcutaneous tissue during administration. It results in local reactions ranging from local irritation, swelling, erythema, burning, and pain at injected site to severe tissue destruction and necrosis (Issani, 2022). Oncology nurses play an important role in the identification, prevention, and management of the chemotherapy extravasation (Atay, Üzen Cura, & Efil, 2021). They should assess vein continuously and maintain good practice to promote patient safety, prevent and manage extravasation (Karius, & Colvin, 2021).

Concerning the studied nurses' demographic characteristics, the present study showed that three quarter of studied nurses were aged between twenty to less than thirty years. This finding is consistent with Mansour, (2019) who reported that slightly more than half of oncology nurses were between twenty to twenty nine years old. While the study done by Prakash et al., (2022) disagreed with the present study finding, who reported that more than half of studied nurses' age ranged from thirty to less than fifty years.

Pointing to education level, slightly more than two third of the studied nurses had nursing technician education. This finding in accordance with Mamdouh Zakaria, Mohamed Alaa, and Mohamed Desoky, (2022) who found that high

percent of studied nurses had technician institute graduate , but this is not congruent with Abu Sharour, Subih, Bani Salameh, and Malak, (2021) who stated that majority of the studied nurses had a bachelor degree of nursing. This may be related to hospital policy employs two head nurse in supervision position in each department.

Concerning years of experience, the present study indicated that slightly more than two fifth of the studied nurses had five to less than ten years' experience at oncology center. This finding agreed with study by Hussin and Ahmed, (2020) who noticed that high present of the studied nurses had five to nine years of working in the oncology unit. Another study done by Abdullah, and Rasheed, (2018) disagreed with present study, they reported that the majority of nurses had experience ranged from one to five years at oncology unit. This may be related to the chemotherapy instillation unite is very critical area and requires experienced nurses for providing chemotherapy.

The current study demonstrated that there was statistically significant improvement in nurses' knowledge levels regarding chemotherapy extravasation post educational intervention. These results are in same line with the study conducted by Prakash et al., (2022) who found that there was a significant difference of nurses' knowledge regarding management of chemotherapeutic drugs extravasation before and after teaching program among staff nurses . Moreover, Chan et al.,( 2020) who demonstrated that there was a significant improvement in the nurses' knowledge after the educational program. Furthermore, El-Fadl, (2020) who reported that there was statistically significant improvement in the studied nurses' knowledge regarding chemotherapy extravasation after program implementation.

This study finding may be due to the simplest of language used in the educational session, readiness of nurses to know about extravasation , different coloured educational media used during teaching session , written guidelines for management of chemotherapy extravasation don't be present in area where nurses administer chemotherapy and lack of continuous educational programs for nurses regarding extravasation.

The current study showed that there was statistically significant improvement in nurses' practice levels post educational intervention . This result is consistent with a study by Chan et al., (2020) who found that the implementation of clinical practices program improved nurses' practice regarding prevention and treatment of

extravasation. Also, Hamdy Abd El-Salaheen, Moustafa Hegazy, Hamed Mahmoud, and Sobhy Omran, (2022) they revealed that there was a positive effect of the program on increasing nurses' practice and there is a statistically significant difference between pre and post program implementation. Additionally, Ammar, and Elderiny (2019) they reported that there was a statistically significant improvement in nurses' practices post program implementation. This may be attributed to improvement in nurses' knowledge post educational intervention.

The results of this study showed that there was positive statistically significant correlation between knowledge and practice of the studied nurses regarding chemotherapy extravasation pre and post educational intervention .This is in the line with the study of Mansour, (2019) who stated a significant association between nurses' knowledge and practices. This may be related to when the knowledge increases, practice also increases.

#### **6.Conclusion:**

Based on the results of the current study it can be concluded there were statistically significant improvement in nurses' knowledge and practice regarding chemotherapy extravasation post educational intervention.

#### **7.Recommendations:**

**Based on the finding of the study, the following recommendations are suggested:**

1. Establishing an orientation program for newly recruited nurses regarding the basic clinical skills regarding chemotherapy administration.
2. Availability of written guidelines for nurses regarding management of chemotherapy extravasation is very essential.
3. Continuous in-service training programs for oncology nurses regarding updated in prevention and management of intravenous chemotherapy extravasation.

#### **For Further Researcher:**

1. The same study could be replicated on a large sample size of oncology nurses and acquired from different geographic areas to facilitate generalization of results.

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