Novelty Journals

ISSN 2394-7330

International Journal of Novel Research in Healthcare and Nursing
Vol. 2, Issue 3, pp: (107-119), Month: September-December 2015, Available at: www.noveltyjournals.com

Evaluation of Handling Practices of Oncology Nurses during Chemotherapy Preparation and Administration in Menoufia Oncology Hospital

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Abstract: **Chemotherapeutic agents are known to be carcinogenic, teratogenic and mutagenic to humans. Occupational exposure to chemotherapeutic agents is a potential risk. Healthcare workers especially nurse who prepare and administer chemotherapeutic drugs may experience the cytotoxic effects of the drugs through direct skin contact, respiratory and digestive system exposure, and these effects are vital to human life. Aim of the study: first, to evaluate the nurse's practice (safety measures) during chemotherapy preparation and administration, second, to identify potential risk factors that may predispose nurses to chemotherapy hazards. Design: A descriptive study carried out during six months from July to December 2012at Menofia oncology hospital .Sample: A study group of 30 oncology nurses of Menoufia oncology hospital. Tools: 1-An interviewing questionnaire, that covering sociodemographic data, knowledge related to chemotherapy preparation and administration, health hazards related to exposure to chemotherapy, use of protective measures while dealing with drugs and barriers of use it. 2-Observational checklist, to assess nurses' actual practices of preparation and administration of chemotherapy .Results: The nurses did not comply with recommended safety behavior (rules and regulations) due to workload , lack of knowledge and lack of equipment and facilities .This study revealed poor safety protective measures among nurses handling cytotoxic drugs which had negative effect on their health Recommendations: The need for nurse's educational programme to increase their awareness and knowledge regards use of chemotherapy and protection from its health hazards**

Keywords: **chemotherapy, cytotoxic agents; Health Hazards, Handling Practice, Protective Measures.**

1. INTRODUCTION

There were more than 11 million cancer cases diagnosed each year worldwide and expected to rise to 16 million by the year 2020. The rising patient number leads to an increase in the use of chemotherapy drugs (CDs) and so much more possibility of exposure of the health-care workers to these drugs. The number of staff potentially exposed to hazardous effect of the CDs was more than5.5 million[1, 2]

The year 2010 marked 4 decades of concern for health care workers exposed to cytotoxic and other hazardous drugs. As a new generation of health care workers joins those already engaged in patient care it is essential that they understand the occupational risks associated with the handling of hazardous drugs and the need for training in proper techniques for all handling activities to reduce occupational exposure to such drugs. The present study was carried out to determine the health hazards among nurses exposed to chemotherapeutic drugs, determine the safety measures on personal and environmental protection during CDs[3, 12.]

In the USA, the Occupational Safety and Health Administration (OSHA) Directives developed standards of preventive precautions for use during the administration of cytotoxic drugs. Valanis et al. created a report concerning protective precautions of health-care workers preparing and administering cytotoxic drugs. These standards were developed to decrease the risk of exposure to cytotoxic drugs, with particular regard to chemotherapeutic drugs[11], [9]

Many antineoplastic drugs are known to be carcinogenic, teratogenic and mutagenic to human [1].Recent studies show the increase in the potential risks due to occupational exposure to cytotoxic drugs (CDs)Occupational exposure is important because physical, economic and socio cultural factors are major determinants of behavior relevant to cancer[4]. Exposure and absorption occur during the preparation and administration in health care practice[,7,8] Nurses and pharmacists are the main groups that are exposed to these drugs in the ambulatory care and hospital settings Exposure may result from direct contact via skin or eyes and inhalation of droplets aerosolization,mainly because of inappropriate hygienic behavior such as eating ,drinking ,or smoking during preparation ,administration, or disposal of CDs [3,6]Among chronic effect and health hazards of CDs are cancer ,fertility problems, long term genetic changes in off-spring, abortion and abnormalities in the fetus[,5,6,7]

Although there has been an increase awareness and concern regarding the issue of safe handling of CDs, many nurses still do not follow the guidelines and procedures in the hospital settings and are not using the recommended safety equipment [8] In our hospitals especially nurses are exposed while preparing and administrating the CDs.For that reason nurses information about the possible toxicities and the protection measures used while preparing and administering these drugs is gaining more and more importance [9].

The affected staff containing shipping and receiving personnel, pharmacists and pharmacy technicians, nursing Personnel, physicians, operating room personnel, environmental services personnel, research laboratory personnel and workers in veterinary practices. Despite of the expanding use of antineoplastic drugs, the number of workers who are properly trained for safe handling has not increased over the past few years.[12,13]

Nurses are among the main groups of professionals that are exposed to these drugs in patient care settings.[1] Although the potential therapeutic benefits of hazardous drugs outweigh the risks of side effects for ill patients, exposed nurses risk these same side effects with no therapeutic benefit.[2] Exposure to the CD of health-care workers is through some organ including skin contact, respiratory or digestive system exposure ingestion, or injection. Inhalation and skin contact, inappropriate hygienic behaviors such as eating, drinking or smoking during preparation, administration, or disposal of CDs [6] are wrong behaviors' that increase the risk of exposure. [2, 8,9]

Particularly, nurses who are primarily responsible for patient care May under risk during chemotherapy preparation and administration. Investigations have shown that strong association between workplace exposures to antineoplastic drugs and acute health awareness of toxic effects of cancer chemotherapeutic drugs typically influences treatment plans for patients undergoing cancer therapy to prevent or mitigate adverse outcomes. However, beyond the patient safety concerns arising from the necessary therapeutic use of these drugs, occupational risks to health care workers handling these drugs in the course of their duties still need to be fully addressed[4-5] effects, primarily in nurses. These included hair loss, headache, acute irritation and/or hypersensitivity as well as adverse reproductive outcomes, including infertility, spontaneous abortions and congenital malformations.[10]

2. SUBJECTS AND METHOD

Subjects:

- A convenience sample of 30 nurses from Menoufia oncology hospital was chosen to achieve the aim of the study.
- All participants should be involved in handling and administrating chemotherapeutic drugs.

Design:

A descriptive research design was utilized.

Setting:

The study was conducted at oncology hospital in Menoufia oncology hospital.

Tools:

Two tools were utilized for data collection. These tools are as follow:

Tool I : An interviewing questionnaire

It was constructed by the researchers to assess nurses' knowledge about safe handling and administration of chemotherapeutic drugs. It includes four parts: **Part one**: sociodemographic data. It comprised of information about: Nurses' age, sex, marital status, educational level, years of experience as oncology nurse, fertility history, , frequency of regular medical checkup, complains due to chemotherapeutic exposure and previous training about safe handling and administration of chemotherapy.

Part two: Oncology unit assessment. It included data about assessment of oncology unit by the subjects as adequacy of personnel protective barriers in the unit: gloves, gowns and masks, adequacy of time to follow the precautions, head nurse' role in correcting wrong practices, adequate chance for training about

Chemotherapy safety protocol, presence of strict polices and procedure in the unit to decrease hazards' exposure to chemotherapy and cleanliness, tidiness and crowded unit.1`

Part three: knowledge about chemotherapy. The form was developed according to the principles and standards of OSHA Directives (occupational safety and related literature. [13–19]

It contained Standard preventive health administration) precautions regarding the preparation and administration of chemotherapeutic drugs based on the literature. This form was designed in two parts. Nurses were asked questions about chemotherapy preparation (12questions) and administration (16 questions).

Part four: reasons for not following the chemotherapy safety protocol.

Tool II: observational check list:

It was developed by the researchers to assess nurses' actual practice of handling and administration of chemotherapeutic drugs and dealing with patients' excreta. It consisted of statements to be checked by the researchers if it carried out by the subjects or not such as: no eating, drinking, smoking or doing make up at areas of drug administration, wearing personnel protective barriers, immediate change of any contaminated personnel protective barriers after contact with chemotherapy, dispose patients' excreta correctly, washing hands thoroughly after any contact with chemotherapy, washing skin and eye immediately after chemotherapy splashes and cleaning solid surfaces correctly.

METHOD:

After an explanation of the aim of the study, permission was obtained from hospitals directors and the head nurses of both setting.

Tool Development: all tools were developed by the researchers after extensive review of literature, and then they were tested for its content validity by five experts in the field of Nursing and Oncology specialty to ascertain relevance and completeness.

• Nurses' verbal approval to participate in the study was obtained after explanation of the aim of the study to each subject. The researchers introduced themselves to all subjects then they were reassured that any information obtained would be confidential and only will be used for the study's aim. The researchers emphasized that participation in the study is entirely voluntary and anonymity of subjects were assured through coding data.

• A pilot study was conducted prior to data collection on five nurses to test clarity and applicability of the tools and the designed protocol, estimate the time needed to collect data and then the necessary modifications were done accordingly. Subjects in the pilot study were excluded from the actual study.

Data Collections:

a. Data were collected over a period of six months from beginning of July to the end of December 2012.

b. A convenience sample was taken at Menofia oncology hospital. Sample a study group of 30 oncology nurses.

c. Each subject was interviewed individually to collect their sociodemographic data and also collect data about their oncology unit by using part one and two of tool I.

d. Each subject was assessed for her knowledge about chemotherapy and ways of safe handling and administration of these drugs by interviewing them individually and using part three of tool I. gathering data of tool I took about 30 minutes for each subject.

e. Each subject was observed individually by the researchers for caring for patients during handling and administration of chemotherapy and dealing with patients' excreta to assess their actual practice regarding these issues by using tool II.

f. All subjects were asked about their for reason of not follow chemotherapy safety protocol using part four of tool I.

Statistical Analysis:

Data was collected, tabulated and statistically analyzed using the SPSS Software Program, version 10.0 for Windows (SPSS Inc ,.Chicago, IL, USA). Descriptive statistics (percentages ,frequencies) were used to illustrate the demographic variables and participants' characteristics.

3. RESULTS

Table (1) illustrated that, thirty nurses participated in this study (30) as a study group in Menoufiya oncology department. Half of the nurses in the age group between (30-40) years and More than three quarters of them(80%) were married and the same percent (80%) were deplume while one nurse only(3.3%) in Baccalaureate degree(the head nurse). Ninety six point seven percent in study group(96.7%) were nurses worked in the profession less than 10 years, all nurses did not received any training in oncology department or a work shop as a training course in chemotherapy.

It was revealed from **table (2)** that majority of the sample (83%) were used gloves in handling of patients wastes, while third of the nurses (33.3%) were using gloves in preparation and caring of patients , and using gloves during cleaning of spills in two third of nurses (66.6%). While other protective measures as (mask, gowning and eye protection) did not used during nursing care activities.

Table (3) revealed that according to nursing answers of half of the nurses are equally between (take of clothes 16.7%, wash hands with soap and water 16.7%, and take off clothes and wash hands 16.7%approxmatily) and the other half of nurses, their answers between 33.3% of them did not take any particular action, and the reminder of 16.7% of them between inform responsible about the accident of contamination.

Table (4) illustrated that during handling area of chemotherapeutic drugs (50%) were eating food and 33.3% drinking beverages and five nurses storing food and beverages at the same area while half of nurses (53.3%)approximately prepare and administer chemotherapeutic drugs in inappropriate place. while (16.7%) of nurses were injured yourself by needle stick and contaminated hands and incorrectly washing hands during chemotherapeutic preparation and administration and different percentage of nurses as (20%) handling contaminated linens and patients clothes. And (10%) of nurses handling of wastes of patients, body fluids and patients dressing. Finally two nurses (6.7%) handling contaminated patient's bed sheet, the least risky nursing activities were handling of contaminated materials as collecting blood ,urine, and stool samples by(3.3%)of nurses by hands.

Table (5) revealed that regards acute symptoms, which happen as a main group of health hazards of CDs hair loss, headaches and skin irritations were approximately the same as (33.3%, 33.3%, and 26.6%) and regards reproductive female symptoms as spontaneous abortion represent two nurses (6.7%) and menstrual changes (10.0%) were three nurses And no percent were found regards (fetal loss, premature delivery, congenital abnormalities, low birth weight, and fertility and sub-fertility).

Table (6):-illustrated that approximately third of the nurses (26.7 %) were facing barriers in our unit as (inadequate equipment's, heavy work load, and lack of knowledge) .While (13.3%) of study sample barriers as not enough time .The little barriers were unsuitable place and crowded and untidy unit were (3.3%).

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Table (1) Demographic Characteristic of Nurses:-

Characteristics	sample (N=30)	
	No	%
-Age(years)		
20-30	8	26.7
30-40	15	50
40-45	7	23.3
-Marital status		
Single	6	20
Married	24	80
-Education		
Deplume	24	80
Ng .institute	5	16
Baccalaureate	1	3.3
-Working duration(years)		
1-4	18	60
5-9	10	33.3
10+yrs	2	6.7
-Training status		
Received	0	0
Not received	30	100
Duration in the profession		
Less than 10 yrs	29	96.7
10-20	1	3.3
More than 20 yrs	0	0
Total	**30**	**100**

Table(2) Use of the Protective Measures when dealing with Patients:

Action	Gloves		Gown		Mask		Eye glasses	
	No	%	No	%	No	%	No	%
Preparation of CDs	10	33.3	0	0	0	0	0	0
Administration of CDs	0	0	0	0	0	0	0	0
Handling patients wastes	25	83.3	0	0	0	0	0	0
Caring of patient	10	33.3	0	0	0	0	0	0
Cleaning of spills	20	66.6	0	0	0	0	0	0

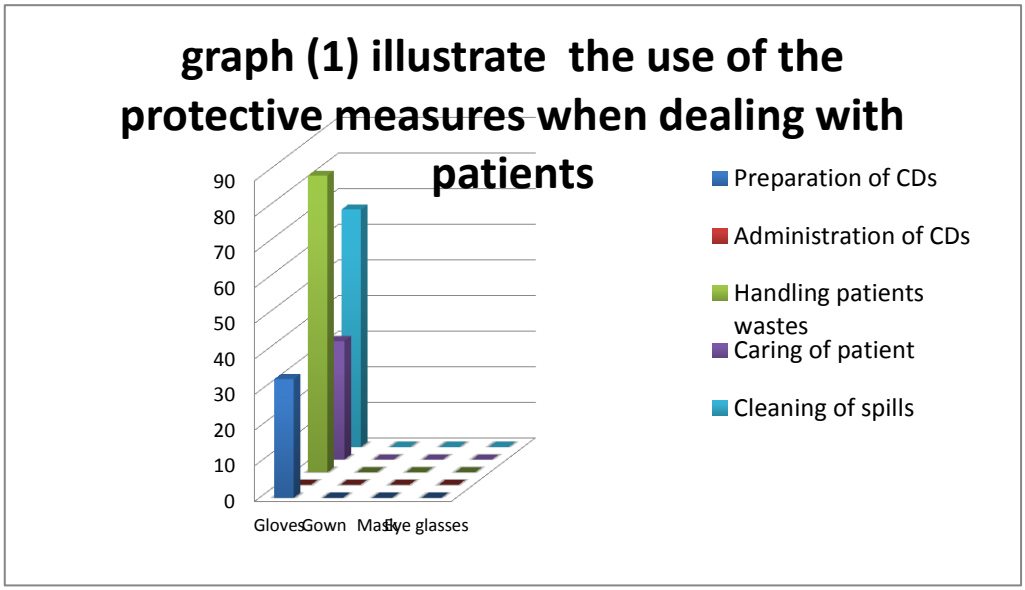

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Table (3) Nursing Actions when contaminated with Chemotherapeutic Drugs:

Nursing Actions	sample(n 30)	
	No	%
Take off clothes.	5	16.7
Wash hands with soap and water	5	16.7
Take off clothes and hand washing	5	16.7
No particular action	10	33.3
Inform employee health professional about accident	3	10
Report the accident to supervisor	2	6.7

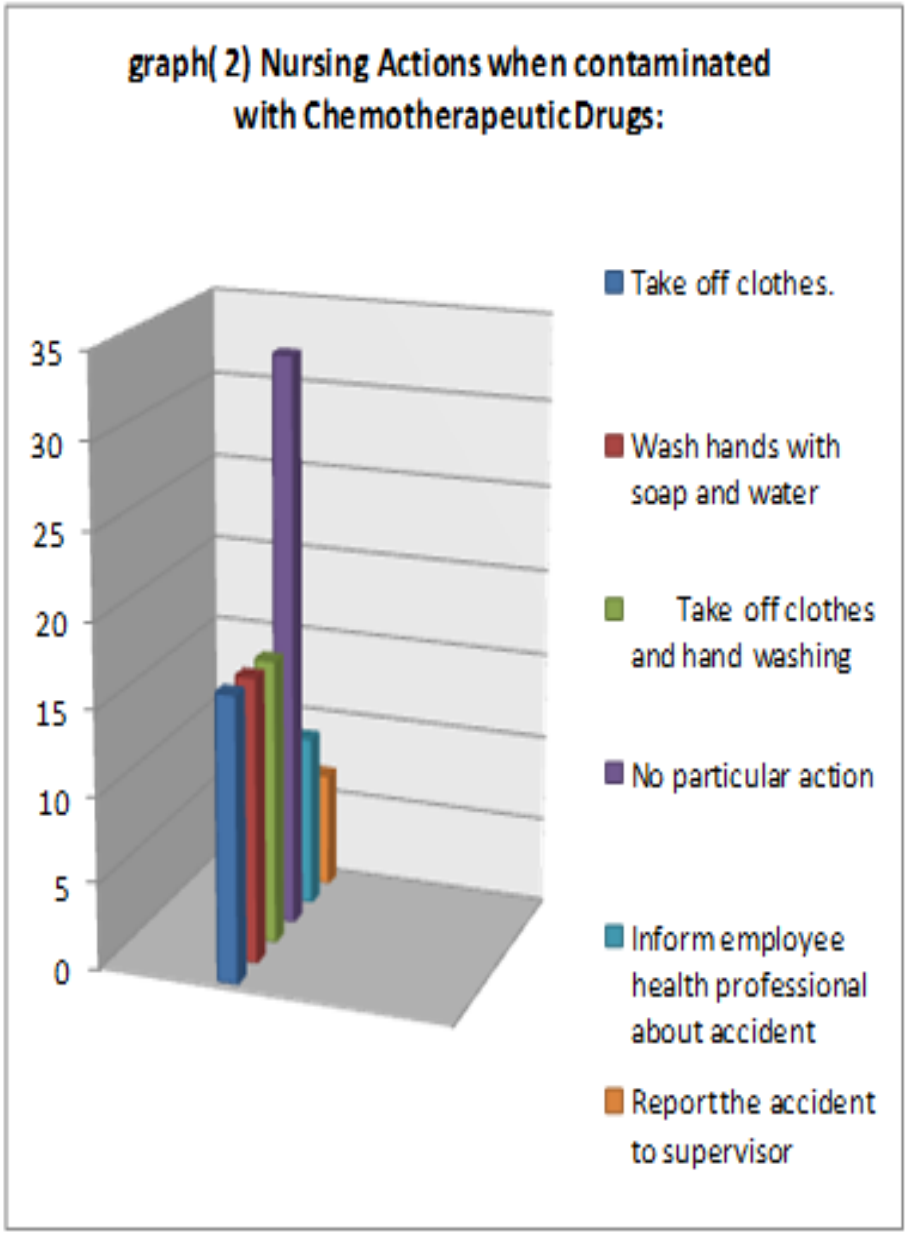

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Table (4) Risky Nursing Activities

Risky nurses activities	sample	
	No	%
In handling areas:		
Eating food	15	50
Drinking beverages	10	33.3
Storing food and beverages	5	16.7
Total	**30**	**100**
Preparing &administer CDs		
Improper place	16	53.3
Needle stick injury	5	16.7
Contaminated hands& poor hand washing	5	16.7
Expelling air from syringe filled with CD	3	10
Collecting of blood ,urine ,stool samples	1	3.3
Total	**30**	**100**
Handling contaminated materials		
Lines and patients clothes	6	20
Wastes of patients	3	10
Body fluids	3	10
Patients dressing	3	10
Patients bed sheets	2	6.7
Cleaning spills	13	43.3
Total	**30**	**100**

graph (3) illustrated the Risky Nursing Activities

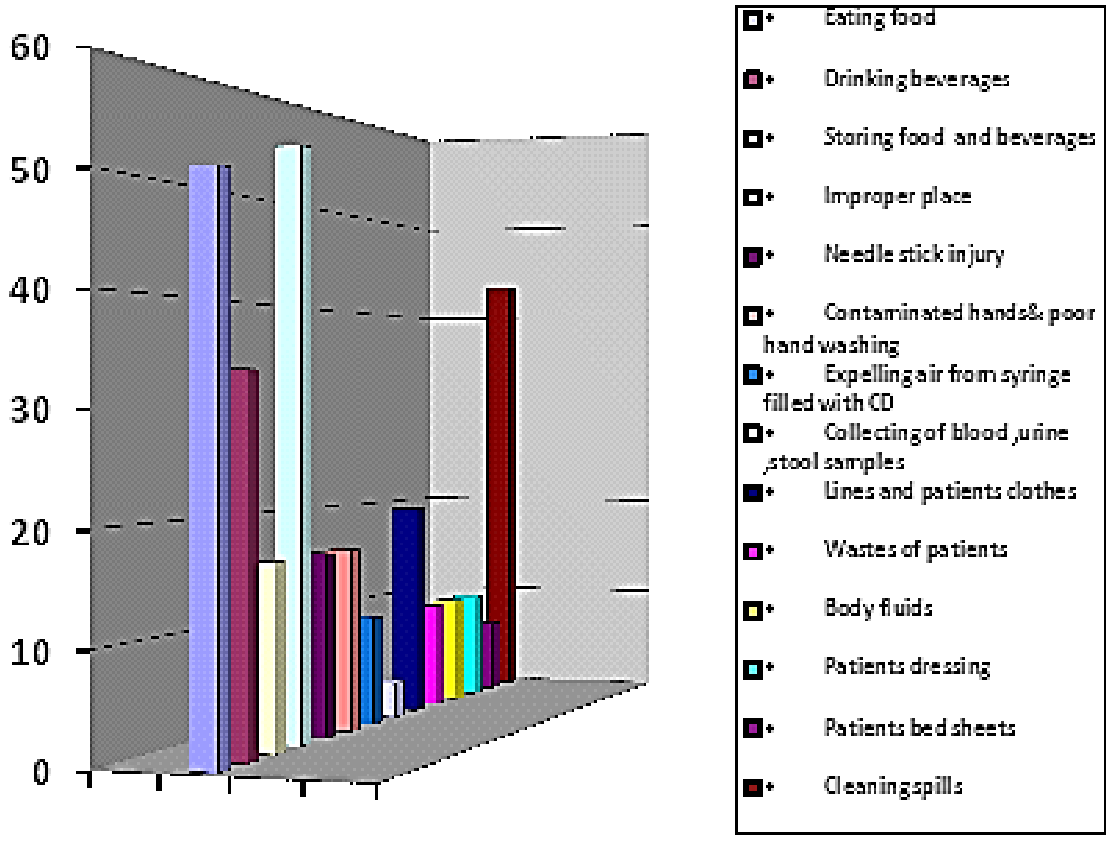

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TABLE (5) Nurses Health Hazards

Nurses health hazards	Sample (N= 30)	
	No	%
1. **Acute symptoms**		
▯ Congenital abnormalities		
Before	0	0
After	1	3.3
▯ Low birth weigh		
Before	0	0
After	1	3.3
Nausea		
Before	0	0
After	1	3.3
▯ Vomiting		
Before	0	0
After	3	10.0
▯ Diarrhea		
	0	0
Before	10	33.3
After		
▯ Dizziness	2	6.7
Before	10	33.3
After		
▯ Headaches	0	0
Before	9	26.6
After		
▯ Skin irritation	0	0
Before	10	33,3
After		
▯ Sore throat		
Before	0	0
After	2	6.7
▯ Hair loss		
Before	0	0
After	0	0
2. Reproductive female symptoms		
▯ Spontaneous abortion		
Before	0	0
After	3	10
▯ Fetal loss		
Before	0	0
After	0	0
▯ Premature delivery		
Before	0	0
After	0	0
▯ Menstrual changes		
Before	0	0
After	0	0
▯ Infertility and sub fertility		
Before		
After		

graph (4) illustrated that Nurses Health Hazards

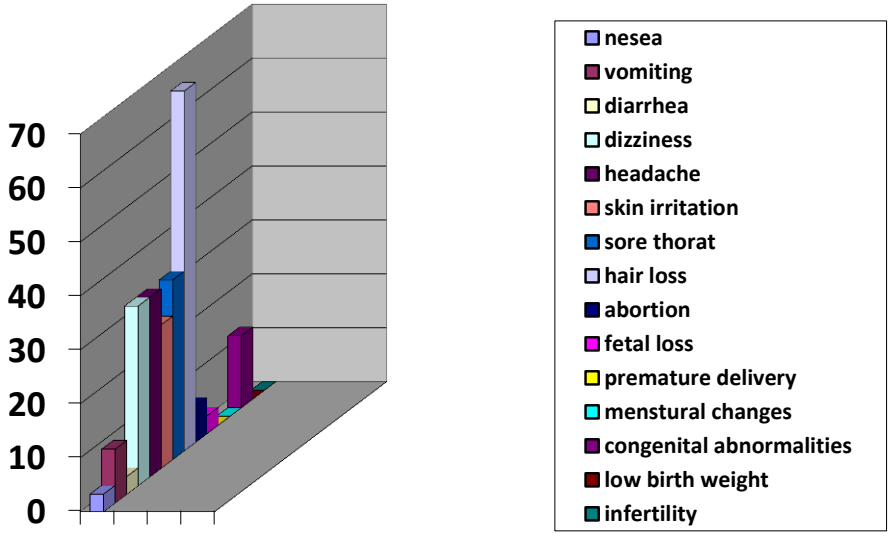
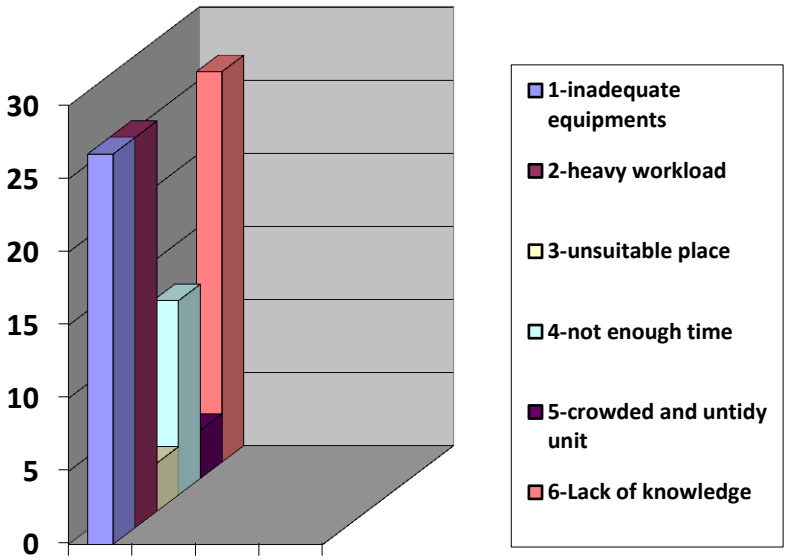


Table 6-Barriers of using nurses for protective measures

Barriers	Sample n (30)	
	no	%
1-inadequate equipments	8	26.7
2-heavy workload	8	26.7
3-unsuitable place	1	3.3
4-not enough time	4	13.3
5-crowded and untidy unit	1	3.3
6-Lack of knowledge	8	26.7
Total	30	100



Graph (5): Barriers of use the protective measures

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4. DISCUSSION

The finding indicates that the majority of nurses were married and in diploma degree and with an experience in the profession of oncology less than 10 years, The finding of this study also indicates that the majority of nurses did not receive any special training in oncology unit , this highlights the need for giving importance for training of nurses in these setting to protect them from toxic effects of CDs. - the results of the present study is in line with study by Kubilay et al which indicate all of nurses preparing and administering chemotherapy have not received any education on chemotherapy and related basic information.[1,2] But the results of the present study is not in the same line with Falck.k,et al, who established that majority of nurses have attended a training program about protection from the harmful effect of chemotherapy[14,15,16]

The study found that half nurses have experienced during contamination with CDs and detected that only very few nurses had proper actions in case of contamination in the current study. All contamination incidents must be reported to the occupational health service, Hand washing before and after working with the patient is essential, and a very little percent of nurses pied attention to hand washing after administration only[17, 19]

In our study there was poor use of gloves, gowns and personal protective equipment among study nurses, when handling patient and cleaning up spills. When handling CDs there was no use of gloves and surgical mask by study nurses but a very small number of them used all of the recommended protective equipment. According to standards set by the OSHA directives, it is routinely that nurses used protective gloves, protective masks, eye glasses and apron during the preparation and administration of CDs. The results about using safety materials during CD preparation are parallel to other studies carried out in our country. These results showed that there is a lack of suitable CD management in our country. Gloves and Aprons protect staff from direct skin contact .It has been proposed that unpowered thick latex gloves during administration. As glove permeability increases by time, they should be changed at the end of every 30 minute for surgical latex but for nitryl at the end of every 60 minute. If gloves torn or contaminated it must be changed immediately regardless of type [22, 25] while In our study, all nurses study did not used any protective materials as gown, mask, and eye glasses due to lack of knowledge and according to their practical experience they think that this measures as gloves did not permit the nurse to palpate the vein of the patient and also due to think that the chemotherapeutic drugs are not infected material and also not harmful [18-20]. In my opinion the idea behind the nurses answers regard not use of protective measures as gloves due to inability to palpate the vain and look for it in appropriate site while regards wearing of eye glasses ,it is the first time to know the using of it in CDs room and related to gown, the nurses wear only the lab coat and when it was contaminated with CDs wash it in their home in dish washer with family clothes and the nurse cannot put mask and work with it and did not used soap and water except the CDs enter nurses eye and when the hand contaminated by CDs the nurse dry it with tissue paper on in their coat [27,28].

Our results about the nurses' safety behavior showed that eating food in handling area with CDs was the most common risky behavior among exposed nurses in study group. Followed by drinking beverages, in improper place for preparing and handling CDs as well as expelling air from syringes filled with CDs were common risky activities. Others included needle stick injuries, contamination of hands, poor hand washing, collection of blood, urine and stool samples, cleaning spills and handling body fluids or contaminated materials these findings showed that the working place was not a safe environment for those nurses. An analytical cross sectional study carried out in Ege University Teaching Hospital by Meral et al 2004 reported that approximately half of the nurses were drinking beverages. The same approximately half of the nurses were storing food and beverages and also half of study group were eating food in the area of CDs

Exposure of health care providers to antineoplastic drugs and the routes of exposure are typically inhalation, dermal or oral. Workers may be exposed by inhalation via droplets, particulates and vapors when they create aerosols and clean up spills. Dermal exposure may occur when workers touch contaminated surfaces during the preparation, administration or disposal of hazardous drugs and oral exposure may occur from hand to mouth contact. Accidental infection with an antineoplastic drugs, although rare has been documented. In handling chemotherapeutic area half of the nurses in study group have at least one risky behavior in the working environment. Only 32.5 % of the nurses declared that they prepare the CDs in proper preparation cabins . Only 45% of the nurses reported that their working environment had proper aspiration system. In a previous study it was reported that 94% of nurses drink and eat in the preparation area for CDs. Although some of the previous studies report similar finding and some studies especially in the more developed countries report that the majority were prepared CDs in a laminar air flow hood.

A meta-analysis of 14 studies performed from 1966 to 2004 in the United States and Europe described an association between exposure to antineoplastic drugs and adverse reproductive effects in health care workers[21]. .The most common reproductive effects found in these studies are increased hair loss, skin irritation, and sore throat (-45%,22% and 11%)-.In this meta-analysis , no significant association was detected between exposure to antineoplastic drugs and congenital malformation , and still birth, ,however a significant association was identified between exposure and spontaneous abortion (one nurse of the study group make an abortion for eight times) .A number of other endpoints has elevated responses ,but are not statistically significant .A study from china that was not included in the meta-analysis reported a significant decrease in full term birth and pre-mature delivery and significant increases in spontaneous abortion [24].A study by Vollono et al [26] documented learning abnormalities in the children of nurses who had handled antineoplastic drugs during the course of their employment

In a study by Obers, et al in the United Kingdom, significant concentrations of several drugs in both personal and area. Concerning barriers for following the safety precautions, it was noticed from the current study that less than half of the study group mentioned that the heavy work load is the main barriers for follow the precautions. This is consistent with the result of Fareed M&Kyprianoul,M [31,30] who mentioned that about half of their sample stated that high work load is the most important factor affecting their compliance to any important behavior [23,24]

Dorgham[30] reported that compliance difference is depending on people areas of work. This result is in line with the finding of the present study which stated that one fifth of study group reported that they did not know the precautions. This result is consistent with OSHA,& Kyprianou[7, 30] who illustrated that the staff handling the chemotherapy doesn't have satisfactory knowledge which is of concern because it increases the health workers unsafe behavior. Minaiac et al 11 added that the overall high rates of adherence to safety guidelines are consistent with the higher level of awareness of hazardous related to chemotherapy

5. CONCLUSION

This study revealed poor safety measures used among nurses handling cytotoxic drugs. There is, therefore, a need to improve the safety of the work environment; make available protective equipment; develop standard practice guidelines for oncology nurses (safety behavior and usage of recommended health safety measures); implement good planning and design of the workplace; provide adequate specialized equipment (such as cytotoxic drug safety cabinets) and personal protective equipment; establish clinical pharmacy practice; and integrate health monitoring programs that include the assessment and counseling of prospective nurses before they commence any work involving cytotoxic drugs and related waste. The study clarify that the need to continuous education, improvement of working environment, stress on correct that the chemotherapeutic agent can harmful to their

6. RECOMMENDATION

1- All staff that work with or may be exposed to cytotoxic drugs must have appropriate hands-on and educational training during orientation and at least annually thereafter

2-Training should cover potential health risks of cytotoxic, appropriate personal protection equipment.

3-Alternative duties should be offered to individuals who are pregnant or breast feeding, because possible reproductive risks are associated with exposure to cytotoxic drugs

4- Urine mutagenicity of the study nurses –"Ames Test towards Salmonella Typhimurinum" TA98with and without S9mix ,gave an increased mutagenic activity and reported the presence of antineoplastic drugs in the urine of the workers who were not preparing the drugs, should be made by hospital for nurses in oncology settings for free.

REFERENCES

[1] NIOSH. Arsenic. In: NIOSH pocket guide to chemical hazards. Washington, DC: U.S. Department of Health and Human Services. Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 97–140.2004.

[2] Duzenli B .Investigation of information level of nurses on protection from harmful effect of chemotherapy. Ist Ntional congress of medwife and nurses abstract book. Antalya; 1,(1):40,2009.

[3] Ben-Ami S,& Shaham J. The influence of nurses' knowledge, attitudes, and health beliefs on their safe behavior with cytotoxic drugs in Israel. Cancer Nursing; 24, 192-200,2007.

[4] Thomas DA,SarrisAH,& Cortes J, 11 study of sphingosomal vincristine in patients with recurrent or refractory adult acute lymphocytic leukemia .Cancer .;106:120-127 , 2006

[5] Aydemire G, and ,Sogukpinar N, Prevention and health education :How recent advances in the science and art of health education have been applied in practical ways within medical and other settings for prevention and public health .Asian Pacific J Cancer Prev; 4:71-6,2008

[6] Micoli G,Turci R,Arpellini M,& Minoia C. Determination of 5-fluorouracil in environmental samples by solid-phase extraction and high- performance liquid chromatography with ultravilot detection. J Chromatoger B.;750:25-32, 2005.

[7] OSHA Technical Manual Controlling Occupational Exposure to hazardous drugs .5th Ed., section 6, Chapter 2, OSHA Publication,1999.

[8] Schreiber C,& ,Radon K .Uptake of antineoplastic agents in pharsmacy personnel .Part11 : Study of work related risk factors .Int Arch Occup Environ Health.; 76:11,2002.

[9] Valanis BG, Vollmer WM, Labuhn KT, &Glass AG. Acute symptoms associated with antineoplastic drug handling among nurses .Cancer Nursing,16:282-295,2007

[10] MeijsterT,FransmanW,Veldhof R,&Kromhout H.,Exosure to Antineoplastic Drugs outside the Hospital Environment .Ann Occup Hyg 0:657-664,2006

[11] Miniac C, Turci R, Sottani C et al. Application of high performance liquid chromatography/tandem mass spectrometry in the environmental and biological monitoring of healthcare personnel occupationally exposed to cyclophosphamide and ifosfamide. Rapid Commun Mass Spectrom; 12:1485–1493, 1998

[12] Wick C, Slawson MH, Jorgenson JA, &Tyler LS. Using a closed system protective device to reduce personnel exposure to antineoplastic agents. Am J Health Syst Pharm 60:2314–2320, 2011.

[13] Connor TH, Anderson RW, Sessink PJ, Broadfield L,& Power LA. Surface contamination with antineoplastic agents in six cancer treatment centers in Canada and the United States. Am J Health Syst Pharm; 56:1427–14321, 2006.

[14] Pethran A, Schierl R, Hauff K, Grimm CH, Boos KS,& Nowak D. Uptake of antineoplastic agents in pharmacy and hospital personnel. Part 1: monitoring of urinary concentrations. Int Arch Occup Environ Health; 76:5–10, 2003.

[15] Vollono C, Badoni G,& Petrelli G. Risk perception and self-assesment of exposure to antineoplastic ,45-47,2010.

[16] Topuz E, Aydiner A, Karadag A. Klinik Onkoloji Kitabı. Tunc Matbaasi, chemotherapy and health hazards , Istanbul,; 35–39,2005

[17] Hrist SAM. A 14-year investigation into the workload of oncology nurses in the Netherlands cancer institute. Cancer Nursing; 13: 303–305,2009.

[18] Tiffany R. Oncology for Nurses and Healthcare Professionals: Pathology, Diagnosis and Treatment I, 2nd edn. London: Harper and Row, 37–45,2007

[19] Burgaz S.(2010) : A signal assay for the detection of genotoxic compounds: Application on the urines of cancer patient on chemotherapy and of nursing handling cytotoxic drugs. Human Toxicology; 7: 557.

[20] Creedon S., Slevin B., Quinn G., Boyle L., Doyle A., O'brien B., O' Connell N. and Ryan L. Hand hygiene compliance:Exploring variating in practice between hospitals. Available at nursing times. 7,(2): 20-24,2008

[21] Kös,gerog˘lu N, Ayranci U, Ozerdogan N,& Demirustu C.Turkish nurses' information about, and administration of, chemotherapeutic drugs. Journal of Clinical Nursing; 5: 1179–1187, 2006

[22] Valanis B, Vollmer WM, Labuhn K, Glass A,& Corelle C. Antineoplastic drug handling protection after OSHA guidelines: Comparison by profession, handling activity and work site. Journal of Occupational Medicine; 34: 149–155, 1999

[23] Kav S. Nursing of cancer patients: oncology nursing. In: TuncerM(eds). Cancer Control in Turkey. T.C Kanserle savas¸ dairesi bas¸kanlıg˘ı. Yayın no: 707agents in a group of nurses and pharmacists. G Ital Med Lav Ergon; 24(1):49-55,2002

[24] Burgaz S and. Karahalil B ,:"Urinary Cyclophosphamide Excertion and Micronuclei Frequencies Lymphocytes and in Exfoliated Buccal Epithelial Cells of Nurses Handling Antineoplastics," Mutation Research, Vol. 439, No. 1, pp. 97-104,1999.

[25] Kosgeroglou N., Ayranci U. ,Ozerdogan N. and Demirustu C.Turkish nurses' information about and administration of chemotherapy drugs. Journal of clinical nursing; 15 [1]:1179-8725),2006.

[26] Vollono, G. Badoni and Petrelli G. "Risk Perception and Self-Assessment of Exposure to Antineoplastic Agents in a Group of Nurses and Pharmacists," Giornale Italiano di Medicina del Lavoro ed Ergonomia, Vol. 24, No. 1, pp. 49-50, 2002.

[27] Sessink, B. C, Wittenhorst, R. B, Anzion, R. P.& Bor, P.s, "Exposure of Pharmacy Technicians to Antineoplastic Agents; Reevaluation after Additional Protective Measures," Archives of Environmental Health, Vol. 52, No. 3, pp. 240-244,1999.

[28] Nygren E and. Lundgren C, "Determination of Platinum in Workroom Air and in Blood and Urine from Nursing Staff Attending Patients Receiving Cisplatin Chemotherapy," International Archives of Occupational Environmental Health, Vol. 70, No. 3, , pp. 209-214 ,2006.

[29] Kubilay G and Fesci Erdem H, "Evaluation of the Status of the Nurses Preparing and Administrating CDs,:" Oncology Nurses' Association, Vol. 6, , pp. 7-15.2010.

[30] Kyprianou M., Kapsou M., Raftopoulos V. and Soteriades E. Knowledge, attitudes and beliefs of Cypriot nurses on the handling of antineoplastic agents European Journal of Oncology Nursing; [1]: 278- 82,2010

[31] Dorgham L.ands Fareed M. Hand hygiene among Egyptian health care students: Nursing versus Medical students. The Egyptian journal of Medicine;43 [4]: 58-69,2010.