Brief Report

How Do Nurses Manage Their Occupational Exposure to Cytotoxic Drugs? A Descriptive Survey in Chemotherapy Settings, Shiraz, Iran

M Momeni[1], M Danaei[2], M Askarian[3]

Abstract

Occupational exposure to cytotoxic drugs is a global concern. We conducted this cross-sectional study in 2012 to describe the adverse effects experienced by nurses working in one of chemotherapy facilities affiliated to Shiraz University of Medical Sciences, Shiraz, southern Iran, and their proper use of personal protective equipment and educational programs. The frequency of side effects reported by participants was noticeably high. Approximately, 60% of the nurses used all personal protective equipment. There were air conditioner ventilation systems in all facilities, but they were not standard. Clinics did not have any dedicated room. Lack of adequate training was noticeable among all participants. We concluded that establishment of safety regulations, health care workers safety surveillance systems as well as continuous training for nurses are of paramount importance.

Keywords: Protective devices; Antineoplastic agents; Occupational exposure; Health personnel; Nurses

[1]Student Research Center, Department of Community Medicine, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Department of Community Medicine, Shiraz University of Medical Sciences, Shiraz, Iran
[3]Department of Community Medicine, Medicinal and Natural Products Chemistry Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

Introduction

Protection of health care workers (HCWs) who are exposed to cytotoxic drugs is a global concern.[1] Working in a chemotherapy unit increases exposure of HCWs, especially nurses, to numerous hazardous materials if they do not protect themselves according to standard guidelines.[2] Occupational exposure may occur directly through preparation, administration and handling of drugs or indirectly through contact with contaminated surfaces and patients' secretions (*e.g.*, urine, vomitus, *etc*). Absorption of a cytotoxic drug may occur via the skin, mucous membrane or through inhalation of drug particles during working hours.[1, 3]

The exposed HCWs may suffer from nausea, vomiting, headache, vertigo, hair loss, abdominal pain, and skin and allergic reactions. Pregnant staffs run risk of developing more serious complications including abortion, congenital anomalies and premature births. Carcinogenicity is the most serious side effect of cytotoxic drugs that would affect HCWs after long-term exposure to them even at miniscule doses.[2-4]

Over the past decades, several standards, regulations and guidelines have been proposed to control occupational ex-

Correspondence to Mehrdad Askarian, MD, Professor of Community Medicine, Department of Community Medicine, Shiraz University of Medical Sciences, PO Box: 71345-1737, Shiraz, Iran
Tel: +98-917-112-5577
Fax: +98-711-235-4431
E-mail: askariam@sums.ac.ir
Received: Oct 30, 2012
Accepted: Jan 26, 2013

Cite this article as: Momeni M, Danaei M, Askarian M. How do nurses manage their occupational exposure to cytotoxic drugs? A descriptive survey in chemotherapy settings, Shiraz, Iran. *Int J Occup Environ Med* 2013;**4**:102-106.

posure to cytotoxic drugs; those cover all aspects including administrative control, engineering control and personal protective equipment.[5]

So far, few studies were conducted about the complications of exposure to antineoplastic drugs and the HCWs compliance with national and international guidelines.[6-9] To the best of our knowledge, little is known about the staffs' safety and their compliance with the standard regulations in the Eastern Mediterranean region. We, therefore, conducted this study in Shiraz, southern Iran, to determine the acute and chronic adverse effects experienced by nurses working in chemotherapy units and their proper use of personal protective equipment. We also asked the nurses about their formal educational programs about cytotoxic drugs.

Materials and Methods

This cross-sectional study was conducted in Shiraz between June and July 2012. All nurses who worked in chemotherapy wards in governmental hospitals and clinics including Nemazi Hospital, Amir Hospital, and Shahid Faghihi and Shahid Motahhari clinics were included in the study. Oral informed consent was obtained from participants. Of 79 eligible nurses, 63 (80%) agreed to participate in the study.

The authors designed a data collection form. The nurses were asked about their demographic information (age, gender, marital status, type of employment as "formal" or "informal," and work experience), experience of new adverse effects during work in chemotherapy wards including acute side effects of cytotoxic drugs (headache, vertigo, nausea, itching, and tearing) as well as chronic side effects (spontaneous abortion, stillbirth, congenital anomalies, infertility, low birth weight, and malignancy), and the nurses' utilization of personal protective equipment in workplace (gloves, glasses, gown, and mask). We also asked the nurses about the availability of air conditioner ventilation system during drug preparation and the total time of training they spent to learn how they should manage their exposure to cytotoxic drugs in the workplace.

We visited the chemotherapy wards without previous notice to check the accuracy of the nurses' reports on the use of personal protective equipment. The existence of a dedicated room in chemotherapy units for drug preparation was also checked. We also evaluated certificates of any formal educational program the nurses had and compared them with what the nurses claimed, themselves.

Results

All nurses participated in this study had bachelor's degree. Approximately 94% of participants were female. The mean±SD age of participants was 31.6±6.1 years; 59% were married. Only 42% of participants were formal employee. They had been working as a nurse for a median of 5.5 years and in oncology wards for three years.

Table 1 shows the side effects experienced by the nurses and the personal protective equipment they used. Headache and skin reactions were the most frequent adverse effects reported by participants. None of the participants reported congenital anomalies or malignancy. Only 60% of participants reported the use of all protective equipment simultaneously; 4% did not use any protective equipment. Gloves and mask were the most frequent equipment used by HCWs in this study.

Air conditioner ventilation systems were widely used in all the studied chemotherapy units; however, the hoods did not comply with the standards. Among the studied places, only hospitals had dedi-

For more information on allergic contact sensitization of nurses see www.theijoem.com/ijoem/index.php/ijoem/article/view/121

cated room for preparation of cytotoxic drugs but there was no specific room in clinics.

According to certificates provided, almost 90% of participants spent a median (IQR) hours of 10 (9) hours for educational programs on the preparation of cytotoxic drugs; 75% spent 6 (10) hours on the management of cytotoxic wastes.

Discussion

In this survey, nurses who worked in chemotherapy units experienced acute side effects of the drugs; the signs and symptoms especially occur at the same time or a little bit after they prepared cytotoxic drugs; the symptoms included headache, skin reactions and treating. These acute side effects in personnel of chemotherapy units were reported from other countries too.[4, 6] Although the frequency of side effects reported by participants are noticeable and in concordance with those in other studies, we did not compare these symptoms in our participants with a control group to avoid reporting biases that may question the validity of our data. Authors could not distinguish that these symptoms were true or somatization; mental disorders and depression related to work satisfaction might explain some of the symptoms.

In this cross-sectional study, chronic side effects were reported rarely, whereas in other studies several side effects, especially malignancy, miscarriage and congenital anomalies, were reported in personnel of chemotherapy wards.[6] The mean age of our participants was almost 32 years; they were too young to develop chronic side effects particularly if we consider their short work experience.

Approximately 5% of participants did not use any protective equipment. The participants used gloves and mask more frequently than gown and glasses. One study from Turkey revealed that nurses working in chemotherapy units did not use adequate post-exposure prophylactic measures. Similar to what we found, the nurses used gloves and mask more frequently than gown and glasses.[4] Therefore, skin and inhalation protection would be more important than eye and body protection. Participants reported headache and skin reactions more frequently than other acute side effects.

Inhalation of cytotoxic drugs is among the most important occupational exposures. Perfect closed system with adequate negative pressure during the drug preparation can reduce the drugs particles in the air circulation.[10] All the chemotherapy facilities studied in this survey, had air conditioner ventilation system but comparing to standards, the existing ventilation systems were old and somewhat defective.[11] The ventilation system used in these facilities must comply with AS 2567–laminar flow cytotoxic drug safety cabinets that are similar to class II BSCs

TAKE-HOME MESSAGE

- The frequency of side effects reported by nurses working in chemotherapy facilities is noticeably high.
- Headache and skin reaction were the most frequent adverse effects reported by the nurses we studied.
- Gloves and mask were the most common protective equipment used by our nurses.
- Air conditioner ventilation systems were widely used in all chemotherapy facilities but they did not comply with the standards.
- Lack of adequate training in nurses was noticeable.
- Establishment of safety regulations, health care workers safety surveillance systems as well as continuous training for nurses are of paramount importance.

Table 1: The frequency of acute and chronic side effects and the use of different personal protective equipment

Acute side effects	Headache	Vertigo	Nausea	Skin reactions	Tearing
n (%)	41 (65)	23 (37)	18 (29)	40 (64)	31 (49)
Chronic side effects	Abortion	Stillbirth	Infertility	Low birth weight	Malignancy
n (%)	2 (3)	2 (3)	2 (3)	2 (3)	0 (0)
Number of personal protective equipment used	One	Two	Three	Four	No equipment
n (%)	4 (6)	5 (8)	14 (22)	38 (60)	2 (3)
Type of protective equipment	Gown	Gloves	Glasses	Mask	Ventilation
n (%)	46 (73)	60 (95)	45 (71)	57 (90)	63 (100)

but have different HEPA filter system.[11] Hospitals and clinics in Shiraz used Class I BSCs ventilators that are not appropriate and safe for cytotoxic drug preparation. Creating a dedicated room in each chemotherapy settings for drug preparation is one practical solution to reduce the occupational exposure to cytotoxic drugs.[12] Among the studied facilities, only hospitals had dedicated room for preparation of cytotoxic drugs.

Several studies showed lack of knowledge about the management of hazardous wastes and incorrect safety practice in HCWs.[13, 14] We found that the mean hours nurses spent in educational programs on cytotoxic waste management was only six hours. According to HAZWOPER standard, staff working in oncology wards require at least 40 hours of training and three days of field experiment at first; it should be repeated annually. Issue of certificate is essential for those who have exposure to hazardous wastes.[15] Lack of adequate training in participants is noticeable in our study.

Authorities should provide enough information to HCWs and monitor the personnel's practice in their workplace to improve their behaviors.[16] In general, focus on HCWs education with new and innovative training methods is very effective. We should target personnel's knowledge and attitude together to change their practice and improve their behavior.[17]

It seems that like other Asian countries, our participants had an incorrect belief about protection and thus do not protect themselves appropriately.[18] Nurses' attitude originates from their culture and religious beliefs. Long-term plans should be developed to correct these beliefs. In the meantime, establishment of safety regulations, HCWs safety surveillance systems as well as continuous training for nurses are of paramount importance.

Acknowledgments

We thank all the nurses who participated in this study for their kind cooperation. The Vice-Chancellor for Research at Shiraz University of Medical Sciences funded this project (grant number: 90-5611).

This research was performed by Mohsen Momeni in partial fulfillment of the requirements for certification as a specialist in community medicine at Shiraz University of Medical Sciences, Shiraz, Iran.

Conflicts of Interest: There was no conflict or competing interest for the authors in establishing this project.

References

1. Ziegler E, Mason HJ, Baxter PJ. Occupational exposure to cytotoxic drugs in two UK oncology wards. *Occupational and environmental medicine* 2002;**59**:608-12.
2. Ahmad A. Managing Cytotoxic Drugs. *Malaysian Journal of Pharmacy* 2003;**1**:63.
3. Furlow B. How to improve the safety of chemotherapy administration. *Oncol Nurse Advisor* 2010;21-5.
4. Baykal U, Seren S, Sokmen S. A description of oncology nurses' working conditions in Turkey. *European journal of oncology nursing* 2009;**13**:368-75.
5. Tarlock AD. Anywhere But Here: An Introduction to State Control of Hazardous Waste Facility Location. *UCLA Journal of Environmental Law and Policy* 1982;**2**:1.
6. Constantinidis TC, Vagka E, Dallidou P, *et al*. Occupational health and safety of personnel handling chemotherapeutic agents in Greek hospitals. *European journal of cancer care* 2011;**20**:123-31.
7. Fransman W, Peelen S, Hilhorst S, *et al*. A pooled analysis to study trends in exposure to antineoplastic drugs among nurses. *The Annals of occupational hygiene* 2007;**51**:231-9.
8. Turci R, Minoia C, Sottani C, *et al*. Occupational exposure to antineoplastic drugs in seven Italian hospitals: the effect of quality assurance and adherence to guidelines. *J Oncol Pharm Pract* 2011;**17**:320-32.
9. Baker ES, Connor TH. Monitoring occupational exposure to cancer chemotherapy drugs. *American journal of health-system pharmacy : AJHP* 1996;**53**:2713-23.
10. Yoshida J, Koda S, Nishida S, *et al*. Association between occupational exposure levels of antineoplastic drugs and work environment in five hospitals in Japan. *J Oncol Pharm Pract* 2011;**17**:29-38.
11. Public Health and Clinical Systems. *Safe Handling of Cytotoxic Drugs and Related Wastes: Guidelines for South Australian Health Services 2012.* Department for Health and Ageing, Government of South Australia, **2012**:33-43.
12. Cazin JL, Gosselin P. Implementing a multiple-isolator unit for centralized preparation of cytotoxic drugs in a cancer center pharmacy. *Pharmacy world & science* 1999;**21**:177-83.
13. Willemson-McBride TL, Gehan K. Safe handling of cytotoxic agents: A team approach. *AORN* 2009;**90**:731-40.
14. Pieri M, Castiglia L, Basilicata P, *et al*. Biological monitoring of nurses exposed to doxorubicin and epirubicin by a validated liquid chromatography/fluorescence detection method. *The Annals of occupational hygiene* 2010;**54**:368-76.
15. Becker P, Morawetz J. Impacts of health and safety education: comparison of worker activities before and after training. *American journal of industrial medicine* 2004;**46**:63-70.
16. Ashley L, Dexter R, Marshall F, *et al*. Improving the safety of chemotherapy administration: an oncology nurse-led failure mode and effects analysis. *Oncology nursing forum* 2011;**38**:E436-44.
17. Mahon SM, Casperson DS, Yackzan S, *et al*. Safe handling practices of cytotoxic drugs: the results of a chapter survey. *Oncology nursing forum* 1994;**21**:1157-65.
18. Patwary MA, O'Hare WT, Sarker MH. Occupational accident: An example of fatalistic beliefs among medical waste workers in Bangladesh. *Safety science* 2012;**50**:76-82.