

Original Article

Determination of Antineoplastic Drug Exposure of Nurses at a University Hospital

Serap Unsar, PhD, MSN, BSN

Professor, Trakya University, Faculty of Health Sciences, Department of Medical Nursing, Edirne, Turkey

Seda Kurt, MSN, BSN

Teaching Assistant, Trakya University, Faculty of Health Sciences, Department of Medical Nursing, Edirne, Turkey

Melahat Akgun Kostak, PhD, MSN, BSN

Assistant Professor, Trakya University, Faculty of Health Sciences, Department of Child Health Nursing, Edirne, Turkey

Rumeysa Yaman

Nursing Student, Trakya University, Faculty of Health Sciences, Department of Nursing, Edirne, Turkey

Merve Özcan

Nursing Student, Trakya University, Faculty of Health Sciences, Department of Nursing, Edirne, Turkey

Correspondence: Serap Unsar, Professor, Trakya University, Faculty of Health Sciences, Department of Medical Nursing, Edirne, Turkey. E-mail. unsarserap@yahoo.com

Abstract

Background: This study was planned as a cross sectional, comparative study to determine exposure-related symptoms of nurses who administer antineoplastic drugs and factors affecting exposure.

Materials and Methods: The study included 73 nurses at a university hospital who administered ($n=32$) or did not administer ($n=41$) antineoplastic drugs. Data were collected using a questionnaire, which included personal and professional characteristics of the nurses and symptoms related to antineoplastic exposure. The data were analysed with the SPSS 19.0 program using percentages, mean values and the Pearson chi-square test.

Results: The average age the nurses was 31.3 ± 6.96 , 71.2% had a bachelor's degree, and 43.8% administered antineoplastic drugs. In the entire study group, 67.1% showed fatigue, 50.7% showed weakness, and 41.1% had hair loss. The symptoms of hair loss ($p<0.001$) and dizziness ($p=0.007$) were significantly more prevalent in nurses who administered antineoplastic drugs.

Conclusions: The nurses did not use sufficient personal protection measures during the preparation and administration of antineoplastic drugs. Training programs are needed to raise awareness of the risks posed by antineoplastic drugs, symptoms of exposure and protective measures.

Keywords: Nurses, antineoplastic drugs, side effects, protective measures

Introduction

Treating cancer through chemotherapy involves the administration of antineoplastic drugs to slow down, reverse or stop the progress of neoplastic diseases. Many chemotherapeutic and antineoplastic drugs used to prevent the growth of cancer cells are

cytotoxic. Health care professionals have an important role in the preparation, administration, storage and waste disposal of antineoplastic drugs (TONS 2009, Zenciroğlu 2011). In Turkey, the preparation and administration of drugs, including chemotherapeutic drugs, in health institutions are the responsibility of nurses.

Thus, they are frequently exposed to the toxic effects of chemotherapy (Pinar 2003, Köşgeroğlu et al., 2008, Zenciroğlu 2011). Nurses who are in closer and longer contact with the patient compared to other health care professionals also experience more exposure after chemotherapy during the routine care of the patient. Some cytotoxic drugs remain in body waste, such as faeces, urine and sweat for 48 h, whereas others may remain for 3 to 5 days. Oral, respiratory and percutaneous intake of such drugs during their preparation and administration during regular nursing care can cause serious complications in nurses (Ziegler et al. 2002, Köşgeroğlu et al., 2008).

Studies have reported an increase in occupational risks related to the increase in the variety, dosage and prevalence of antineoplastic drugs and highlighted the necessity and importance of using these drugs safely (TONS 2009, Türk et al. 2004, Constantinidis et al. 2011). In a study of 137 Turkish oncology nurses, Türk et al. (2004) reported that the nurses had an insufficient level of knowledge about antineoplastics. The same study found that only 4.4% and 1.4% of nurses used correct protective equipment during the handling of cytotoxic drugs and during 'risk clinical activities', respectively. Constantinidis et al. (2011) reported that safety practices were poor in their hospital in Greece, and that nurses experienced various occupational drug exposure-related health problems affecting the respiratory, central nervous system, reproductive, gastrointestinal and musculoskeletal systems.

According to the literature, most cytotoxic drugs used in cancer treatment are mutagenic, teratogenic or carcinogenic (Köşgeroğlu et al. 2008, Ziegler et al. 2002, Momeni et al. 2013). Thus, it is important to have access to and to use appropriate safety equipment and materials during the preparation, administration and disposal of cytotoxic drugs. Studies have reported various negative effects of cytotoxic agents on health professionals exposed to these drugs via various routes. These include nausea-vomiting, diarrhoea, eye and throat irritation, coughing, menstrual disorders, allergic skin reactions, hair loss, abdominal pain, headaches, dizziness, corneal ulcers,

fatigue and frequent infections (Zenciroğlu 2011, Köşgeroğlu et al. 2008, Constantinidis et al. 2011, Türk et al. 2004). Increasing the level of awareness of nurses about symptoms related to antineoplastic drug exposure would highlight the occupational risks related to antineoplastics and the importance of safety measures. We examined exposure-related symptoms of nurses who administer antineoplastic drugs and factors associated with exposure.

Materials and methods

Design and sample

This study was designed as a cross sectional, comparative study. It consisted of 73 nurses at a university hospital in Edirne, Turkey who administered ($n=32$) or did not administer ($n=41$) antineoplastic drugs. The study was conducted on March-April 2014 with nurses who volunteered to participate.

Data collection tools

A questionnaire was prepared drawing on the literature (Köşgeroğlu et al. 2008, Pinar 2003, Yoshida et al. 2009, Connor & McDiarmid 2006, Constantinidis et al. 2011, Türk et al. 2004). It consisted of three sections and 19 items. The first section consisted of seven items: age, gender, educational level, professional experience, duration of working in current department, status regarding the administration of antineoplastics and duration of administering. The second section consisted of questions on four safety items (masks, gloves, protective aprons and goggles) that the nurses used during the preparation and administration of antineoplastics. The third section consisted of nine items on exposure-related symptoms: fatigue, weakness, hair loss, loss of appetite, dizziness, mouth sores, skin rashes, allergic reactions and menstrual cycle disorders.

Ethical considerations

Written permission was obtained from the institution where the study was conducted. We informed the nurses about the study before completing the questionnaire, and all provided oral consent.

Statistical analysis

The data were analysed with the SPSS 19.0

program. The descriptive characteristics, symptoms and safety measures of the nurses were evaluated using percentages and averages, plus standard deviation. To compare the symptoms of the nurses who did or did not administer antineoplastics, the Pearson chi-square test was used. Values of $p < 0.05$ were considered statistically significant.

Results

The average age of the nurses was 31.3 ± 6.96 , all were female, and 71.2% had a bachelor's degree. The average professional experience of the nurses was 9.80 ± 7.58 years, and the average duration of working in the oncology clinic was 5.5 ± 6.1 years. In this study, 43.8% of the nurses administered antineoplastic drugs. 46.9% of the antineoplastic drugs were prepared in a robotic system, 46.9% was prepared in a safety cabinet, and 28.1% was prepared in both a safety cabinet and a robotic system (Table 1).

During the preparation and administration of antineoplastic drugs, 96.9% of the nurses used gloves, 78.1% used masks, 56.3% used protective aprons, and only 3.1% used goggles. The most prevalent symptoms among the nurses exposed to antineoplastics were fatigue (78.1%), hair loss (65.6%) and weakness (62.5%). The most prevalent symptoms in those not exposed to these drugs were fatigue (58.5%) and weakness (41.5%) (Fig. 1). The symptoms of hair loss ($p < 0.001$) and dizziness ($p = 0.008$) were significantly more prevalent in nurses who administered antineoplastic drugs ($p < 0.005$) (Table 3). There was no statistically significant difference between nurses who did or did not administer antineoplastic drugs with regard to weakness, fatigue, mouth sores, loss of appetite, skin rashes, allergic reactions and menstrual disorders ($p > 0.05$) (Table 3).

Discussion

In this study, the mean age of the nurses who administered antineoplastic drugs was 31.3 ± 6.96 , and most of the nurses were university graduates. Köşgeroğlu et al. (2008) reported that 62.9% of nurses who administered antineoplastic drugs were university graduates, with a mean age was

30.9. In our study, in nurses exposed to antineoplastic agents, the mean duration of working in oncology clinics was 5.7 years, and the mean number of patients who were administered chemotherapy daily by the nurses was 12.7 ± 19.5 . In our study, most of the nurses had a bachelor's degree. This seemed to have an important effect on their level of awareness of safety precautions during the preparation and administration of antineoplastic agents. The majority of the nurses who administered chemotherapeutic agents were young and of reproductive age. They provided care to a large number of patients, increasing their exposure. In addition, increasing their exposure and risk of potential adverse effects. If nurses do not use appropriate safety precautions, their risk of experiencing acute and chronic side effects of antineoplastic drugs will be increased.

In this study, almost all the nurses used gloves as a safety precaution, three-fourths used masks, and half used protective aprons. Almost none used glasses. Momeni et al. (2013) reported that 60% of nurses used all safety precautions, and 4% used none, with the most common precautions wearing gloves and masks. In a study conducted in Turkey, Olgun and Simsek (2010) reported that nurses used gloves (76.9%), gowns (65.4%), masks (44.6%) and glasses (25.4%) while preparing antineoplastic drugs and that they used gloves (56.2%), gowns (24.6%), masks (44.6%) and protective glasses (2.3%) while administering these drugs (Olgun & Simsek 2010). Similarly, another study found that health personnel mostly used gloves, followed by masks, gown, glasses, bonnets and show covers during the administration and preparation of antineoplastic drugs. Nurses used gloves and masks more frequently than protective aprons and glasses and that they did not use bonnets. In our study, although the nurses took precautions regarding skin and inhalation protection, they did not take sufficient precautions to protect their eyes, head area or body. (Constantinidis et al. 2011). Therefore, the frequency of symptoms, such as dizziness and hair loss, in the nurses who administer antineoplastic agents may be the result of applying insufficient safety precautions.

Table 1. Personal Characteristics and Antineoplastic Drug Administration-Related Characteristics of the Nurses (n=73)

Characteristics	Mean/n (%)
Age	31.3±6.96
Educational level	
High school	11 (15.1)
Associate	7 (9.6)
Bachelor	52 (71.2)
Masters	3 (4.1)
Professional experience	9.80±7.58
Chemotherapy administration status	
Yes	32 (43.8)
No	41 (56.2)
Number of chemotherapy patients treated by the nurses on a daily basis	12.7±19.5
Method of preparing drugs*(n=32)	
Robotic system	15 (46.9)
Safety cabinet	15 (46.9)
Robotic system/safety cabinet	9 (28.1)

*More than one answer.

Table 2. Use of Protective Equipment by Nurses (n=32)

Safety Measures*	n (%)
Gloves	31 (96.9)
Mask	25 (78.1)
Gown	18 (56.3)
Glasses	1 (3.1)

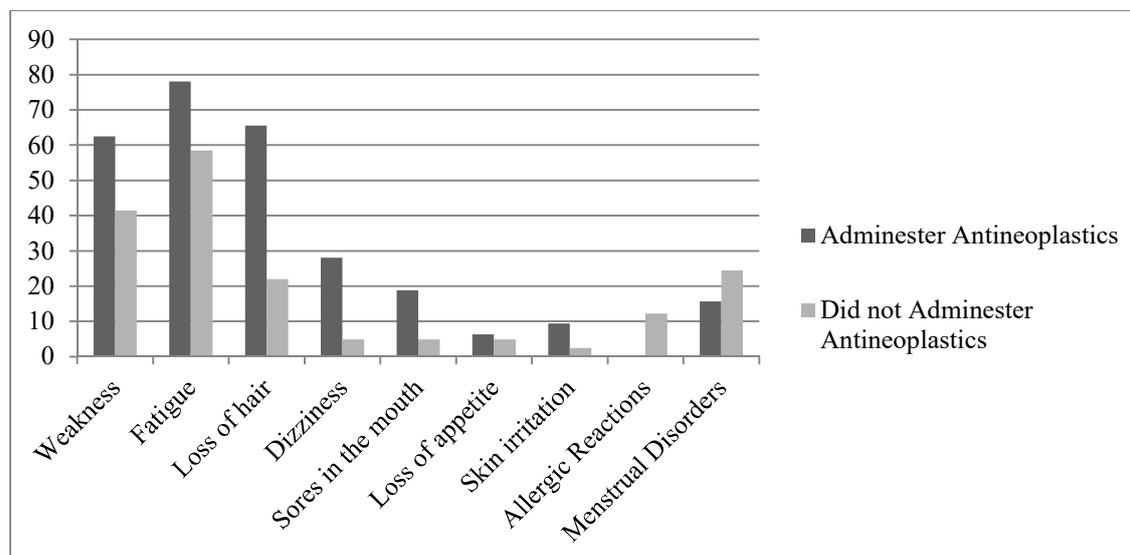
*More than one answer.

Table 3. Comparison of Symptoms Seen in Nurses Who Did and Did Not Administer Antineoplastic Agents

Symptoms	Administer Antineoplastics		Did not Administer Antineoplastics		Chi-square*, p
	Yes	No	Yes	No	
	n (%)	n (%)	n (%)	n (%)	
Weakness	20 (62.5)	12 (37.5)	17 (41.5)	24 (58.5)	3.182, 0.074
Fatigue	25(78.1)	7 (21.9)	24 (58.5)	17 (41.5)	3.125, 0.077
Loss of hair	21 (65.6)	11 (34.4)	9 (22.0)	32 (78.0)	14.161, <0.001
Dizziness	9 (28.1)	23(71.9)	2 (4.9)	39 (95.1)	7.589, 0.007
Sores in the mouth	6 (18.8)	26(81.3)	2 (4.9)	39 (95.1)	3.544, 0.060
Loss of appetite	2 (6.3)	30(93.8)	2 (4.9)	39 (95.1)	0.065, 0.798
Skin irritation	3 (9.4)	29(90.6)	1 (2,4)	40 (97.6)	1.669, 0.196
Allergic reactions	0 (0)	32 (100)	5 (12.2)	36 (87.8)	4.189, 0.041
Menstrual disorders	5 (15.6)	27 (84.4)	10 (24.4)	31 (75.6)	0.846, 0.358

*Pearson

Figure 1. Symptoms Experienced by The Nurses Who Did and Did Not Administer Antineoplastic Agents



In this study, 46.9% of antineoplastic agents were prepared in a robotic system, 46.9% in a safety cabinet, and 28.1% in both a robotic system and safety cabinet. A circular dated 10 May 2005 (numbered 9260), published by the Ministry of Health, General Directorate of Treatment Services and sent to all inpatient treatment institutions, highlighted safety precautions regarding the preparation (including the location), administration, and storage of antineoplastic drugs and the removal of waste (TMH 2005). The dissemination of the circular highlights the concern about the safe administration of antineoplastic agents by health care personnel. The use of biological safety cabins and robotic systems in hospitals is important to reduce the risk of occupational exposure. In Turkey, Köşgeroğlu (2006) reported that 12.2% of nurses used a safety cabinet for preparing antineoplastic drugs, whereas Olgun and Simsek (2010) found that 56.2% used one. Martin and Larson (2003) reported that the rate of non-use of a safety cabinet by nurses was 46%. A study conducted in Cyprus reported that 98.8% of nurses used a safety cabinet for preparing antineoplastic drugs (Kyprianou et al. 2010). In the present study, the nurses used the safety cabinet and the robotic system for preparing antineoplastic drugs, but they were

highly exposed to these drugs due to failure to apply safety precautions.

In the current study, the most common symptoms in nurses who administered antineoplastic drugs were fatigue, hair loss, weakness and dizziness. Köşgeroğlu et al. (2008) reported similar findings in nurses exposed to these drugs. Türket al. (2004) reported that headache, hair loss, weakness and frequent infections were common among those exposed to antineoplastic drugs. In this study, symptoms of dizziness and hair loss were more common in nurses who administered antineoplastic drugs than in those who did not administer these drugs.

Constantinidis et al. (2011) found that the most common symptoms in health personnel who administered antineoplastic drugs were dizziness, nausea, headaches (58.8–59.3%), skin irritation (45.9–47.5%) and allergic reactions (14.9–18.6%). In another study, the most frequent symptoms in nurses who prepared antineoplastic drugs were headaches and skin problems (Kyprianou et al. 2010). In this study, despite the use of the robotic system/safety cabinet for preparing antineoplastic drugs, the insufficient use of personal protective measures (bonnet, apron and glasses) likely explains the symptoms of dizziness and hair loss among the nurses.

Conclusion

We found that nurses mostly used gloves and masks as personal protective measures during antineoplastic drug administration. Symptoms of dizziness and hair loss were more severe in nurses who prepared/administered antineoplastic drugs. In light of these results, it seems important to implement in-service training programs for nurses on the preparation and administration of antineoplastic drugs and to regularly evaluate the training; to ensure adherence to safety administration standards for reducing the risk of exposure to antineoplastic drugs in health institutions, as recommended by the Oncology Nursing Society (ONS 2013) guidelines; to increase health professionals' awareness of the risks of antineoplastic drugs; to provide routine health check-ups; and to manage symptoms. We also suggest that future comparative and evidence-based studies should be conducted to determine the effects of antineoplastic agents.

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