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Glass Particle Contamination and Using the Filter Needle: A Cross-sectional Study

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ABSTRACT:
Purpose: To identify the levels of knowledge of nurses and physicians about the contamination of micro-sized glass particles in medicine content when opening glass ampoules containing parenteral medicines and the use of filter needles in reducing contamination. When the medicine ampoule is broken and opened, spill into the ampoule and contaminates the medicine. Medicines contaminated with glass particles pose a potential danger when they are administered parenterally to patients.
Material and Methods: This study was planned as a descriptive cross-sectional study. The study was conducted with a total of 600 healthcare professionals, 300 physicians and 300 nurses, working in a university hospital between October and November 2020. The data were collected using the "Personal Information Form" and the "Information Form about Glass Particle Contamination and Filter Needle Use".
Results: The highest response to the question "medicine contaminated with glass particles can cause complications in the patient" was I do not know at 52.7%. The highest number of correct answers at the rate of 76% was given to the question "particle scattering to buffer/fingers at glass ampoule opening". When nurses were asked "presence of micro-sized glass particles in the medicine drawn from the ampoule to the syringe" and "preventing from giving glass particles with the medicine to the patient", the rate of correct answers was higher with significant differences compared to physicians.
Conclusion: Healthcare professionals had moderate knowledge of glass particle contamination and the use of filter needles. Variables such as profession, number of ampoules used in the clinic, and educational status affect the level of knowledge. Findings inform to stresses the need to raise awareness for reducing glass particle contamination.
Keywords: *Contamination; Filter needle; Glass particle; Healthcare professionals*

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INTRODUCTION

The medicines packaged in glass ampoule form are frequently used in many departments that provide health care services such as intensive care units, emergency service departments and operating rooms (Erkoc Hut & Bayır, 2017; Carbone-Traber & Shanks, 1986). These ampoule form medicines are injected to patients by subcutaneous, intramuscular, intravenous, intraarticular and intrathecal routes. When the ampoule is broken and opened, a large number of micro- and/or macro-sized glass particles form, spill into the ampoule and contaminate the medicine (Erkoc Hut & Yazici, 2021). Medicines contaminated with glass particles pose a potential danger when they are administered parenterally to patients (Bukofzer, 2015; Carbone-Traber & Shanks, 1986). In the literature, it is reported that glass particles smaller than 7 µm reach organs such as brain, lung, liver, kidney, spleen and small intestine, lead to inflammatory reactions and damage, and particles in size 7-12 µm block capillaries and cause to embolism and thrombus (Timmons, Liu, & Merkle, 2017; Bukofzer, 2015; Langille, 2013; Jack, 2010; Preston & Hegadoren, 2004). It is emphasized that in addition to various pathological changes such as phlebitis and granuloma, glass particles may also

lead to the development of pulmonary hypertension and granulomatous pulmonary arteritis (Joo, Sohng, & Park, 2016; Jack, 2010; Preston & Hegadoren, 2004; Puntis, 1992; Turco & Davis, 1971). Medicines with glass particle contamination threaten the patient safety (Sogut & Erkoc Hut, 2022). Furthermore, this situation is also considered to negatively affect safe medicine administration. Therefore, it is recommended to use a filter needle when drawing up the medicine from the ampoule for prevent contamination (Cassista et al., 2014; Heiss-Harris & Verklan, 2005; Preston & Hegadoren, 2004; Sabon et al., 1989). The using of filter needles in parenteral medicine administration, risk of health problems in patients may be reduced, and accordingly patient safety can be ensured (Joo, Sohng, & Park, 2016; Harmon, 2014; Heiss-Harris & Verklan, 2005).

No studies were found about the awareness of healthcare professionals about glass particle contamination in parenteral medicines and using filter needle in clinic. Based on this gap in the literature, the aim of this study is to determine the knowledge levels of nurses and physicians about glass particle contamination in ampoule medicines and using filter needle to reduce contamination. For this purpose, answers to the following questions were sought.

Q1: What is the knowledge level of healthcare professionals about glass particle contamination in ampoule form medicines?

Q2: Is there a difference between the knowledge levels of healthcare professionals about glass particle contamination according to their sociodemographic characteristics?

Q3: What is the knowledge level of healthcare professionals about the using filter needle to reduce glass particle contamination?

Q4: Is there a difference between the knowledge levels of healthcare professionals about the using filter needle according to their sociodemographic characteristics?

MATERIAL and METHODS

Purpose and Type of the Study

This is a descriptive, comparative and cross-sectional study.

Sampling and participant

The study was conducted with healthcare professionals in a university hospital between October 2020 and November 2020. A total of 1716 healthcare professionals, including 736 physicians and 980 nurses, working in a university hospital in Istanbul constituted the population of the study. The sample size was calculated using the appropriate sampling method (5% margin of error, 80% power of the study). The sample selection criteria for the study were determined by the "purposive sampling" method. For a more precise evaluation of data, the aim was to reach 300 participants from each occupational group. The sample comprised 35% of the population and the study was completed with 300 nurses and 300 physicians.

The inclusion criteria for the study were agreeing to participate in the study, and working as a physician or nurse in the inpatient departments or outpatient departments of the internal medical sciences and surgical medical sciences, in intensive care units, operating rooms, and in units affiliated with these departments where diagnostic tests are performed and medicine administration is performed in the hospital.

Data Collection Tools

Healthcare professionals included in the study were listed and all of them were visited. Appointments were made for those who wanted to voluntarily participate in the study for time periods when they were available. Before starting interviews with the participants, the Informed Consent Form related to the study was read and their consent was obtained. The data were collected in the form of questions and answers by the researcher with the face-to-face interview method in an area approved by the participants, and responses were recorded on the relevant forms. It took approximately 5 minutes to collect the data and record them on the relevant forms. The data were collected using the "Personal Information Form" prepared by the researcher in accordance with the literature and the “Information Form about Glass Particle Contamination and Filter Needle Use” (Harmon, 2014; Zabir, Choy, & Rushdan, 2008; Sabon et al.,1989).

Personal Information Form

This included 12 questions about the personal (age, gender, etc.) and descriptive characteristics of healthcare professionals regarding medicine use in ampoule form (average number of ampoules used daily in the unit, opening techniques for glass ampoule medicines, etc.).

Information Form about Glass Particle Contamination and Filter Needle Use

This included 8 questions about participant information regarding glass particle contamination and filter needle use (micro-sized glass particles from the ampoule neck contaminate the medicine, cause complications, etc.) during the opening of the glass ampoule medicines. Since all of the questions constituted verbal data, answer options of "Yes", "No" and "I don't know" were created. The items from 1st question and the 8th question measuring the knowledge level of the participants were used in order to test the internal consistency of the responses of healthcare professionals. The participants were given "1 point" for the correct answer to each item and "0 points" for the wrong answer or the answer I don't know. In this state, the Kuder-Richardson 20 test, which is used to test the internal consistency of the answers given to true-false type questions, was performed and the internal consistency coefficient was calculated as $\alpha = 0.70$. The answer “Yes” for the 1st, 2nd, 3rd, 4th, 6th, 7th and 8th questions and the answer “No” for the 5th question were considered correct in order to perform the analyses. It was considered that all participants who answered "I don't know" gave an incorrect answer to the relevant question.

Statistical Analysis

The data obtained as a result of the study were evaluated in the computer environment using the IBM SPSS Statistics 21 package program. The data were analyzed at a confidence interval of 95% and at a significance level of $p<0.05$. For the analysis of the data, descriptive (number, percentage), psychometric (Kuder-Richardson 20) and non-parametric comparison analyses (Chi-square) were used.

Ethical Approval

Ethics committee approval was obtained from a university (March 05, 2020; Decision No: 38298), following international standards and the principles adopted by the World Medical Association Declaration of Helsinki. Institutional approval was obtained from the departments of nursing at the universities. Verbal and written consent were obtained from nurses and physicians. The Informed Consent Form was read and their consent was obtained.

RESULTS

Demographic characteristics

The mean age of the healthcare professionals was 32.08 ± 6.66 (Min= 21, Max= 65) years and the majority (64.5%) of them were female. Of the nurses, 86.3% had undergraduate education or higher. Among the healthcare professionals, 48.3% worked in the departments related to internal medicine sciences and 51.7% of them worked in departments related to surgical medicine sciences in the hospital. The professional experience was 9.01 ± 7.48 years (Min= 1, Max= 34) for nurses and 5.78 ± 5.50 years (Min= 1, Max= 38) for physicians. Glass ampoule medicines were used in all departments where healthcare professionals worked. The mean number of glass ampoule medicines used per day was 44.71 ± 25.76 (Min= 2 , Max= 300) in the department of employment, that these ampoules were mostly (71.5%) broken with bare hands, and that a 21 Gauge (G) needle was used to draw the medicines into the syringe by 80.5% (Table 1). The glass ampoule medicines were administered to patients most frequently by intravenous (98.5%) and intramuscular (78.8%) routes (Table 1).

Healthcare professional knowledge about glass particle contamination and the use of filter needles

The answers of healthcare professionals to the questions about glass particle contamination and the use of filter needles are presented in Table 2. While 75.3% of the healthcare professionals indicated that micro-sized glass particles spilled from the ampoule neck into the ampoule when opening glass ampoule medicines and contaminated the medicine, it was determined that 52.7% of them did not have any

idea whether complications occurred in the patient when medicines with glass particle contamination were used. Most knew that glass particles were scattered on the buffer that touches the neck of the ampoule while opening it, that the needle diameter used when drawing the medicine from the ampoule into the syringe was effective in reducing the passage of glass particles, and that there were micro-sized glass particles in the medicine drawn into the syringe. However, only 44.7% of healthcare professionals indicated that measures could be taken to prevent administration of glass particles to the patient with the medicine.

The rate of healthcare professionals answering the questions correctly were rated as follows; less than 40% was poor knowledge level, between 40-60% was moderate knowledge level, and over 60% was good knowledge level.

Table 1. Distribution of descriptive characteristics of healthcare professionals

Descriptive characteristics		Nurse (n = 300)	Physician (n = 300)	Total (n = 600)
		n (%)	n (%)	n (%)
Gender	Female	239 (79.7)	148 (49.3)	387 (64.5)
	Male	61 (20.3)	152 (50.7)	213 (35.5)
Educational status	High school and pre-graduate education	44 (14.7)	-	44 (7.3)
	Undergraduate	217 (72.3)	-	217 (36.2)
	Master's Degree	37 (13.3)	273 (91.0)	310 (51.7)
	PhD Degree	2 (0.7)	27 (9.0)	29 (4.8)
Working departments	Medical departments	140 (46.7)	150 (50.0)	290 (48.3)
	Surgical departments	160 (53.3)	150 (50.0)	310 (51.7)
Ampoule opening technique	Cotton buffer	41 (13.7)	9 (3.0)	50 (8.3)
	Ampoule opener	1 (0.3)	-	1 (0.2)
	Sponge	10 (3.3)	-	10 (1.7)
	Syringe sheath	84 (28.0)	26 (8.7)	110 (18.3)
	Bare hands	164 (54.7)	265 (88.3)	429 (71.5)
Needle diameter used when drawing up medicine	18 G	36 (12.0)	51 (17.0)	87 (14.5)
	21 G	256 (85.3)	227 (75.7)	483 (80.5)
	22 G	7 (2.3)	15 (5.0)	22 (3.7)
	Other	1 (0.3)	7 (2.3)	8 (1.3)

G: Gauge

Table 2. Distribution of statements about glass particle contamination and the using of filter needles

Questions about glass particle contamination and the using of filter needle	Yes	No	I do not know	Knowledge level
	n (%)	n (%)	n (%)	%
1.Micro glass particle contamination occurs when opening the ampoule	452 (75.3)	34 (5.7)	114 (19.0)	75.3
2.Medicine contaminated with glass particles can cause complications in the patient	169 (28.2)	115 (19.2)	316 (52.7)	28.2
3.Particle scattering to buffer/fingers at glass ampoule opening	456 (76.0)	35 (5.8)	109 (18.2)	76.0
4.Large volume ampoules cause more glass particle contamination than small volume ampoules	271 (45.2)	65 (10.8)	264 (44.0)	45.2
5.Using a needle with a small lumen diameter prevents glass particles from being drawn into the syringe	69 (11.5)	279 (46.5)	252 (42.0)	46.2
6.The diameter of the needle is effective in reducing the passage of glass particles	436 (72.7)	56 (9.3)	108 (18.0)	72.7
7.Presence of micro-sized glass particles in the medicine drawn from the ampoule to the syringe	340 (56.7)	56 (9.3)	204 (34.0)	56.7
8.Preventing from giving glass particles with the medicine to the patient	268 (44.7)	39 (6.5)	293 (48.8)	44.7

"Yes" answer correct =1st, 2nd, 3rd, 4th, 6th, 7th and 8th questions; "No" answer correct = 5th question

< 40% = poor knowledge, 40-60% = moderate knowledge, >60% = good knowledge

Table 3. Distribution of correct answers to the questions in terms of profession

Questions about glass particle contamination and the using of filter needles	Profession	False	True	P-Value
		n (%)	n (%)	
1. Micro glass particle contamination occurs when opening the ampoule	Nurse	62 (20.7)	238 (79.3)	χ^2 =5.166
	Physician	86 (28.7)	214 (71.3)	p<0.023*
2. Medicine contaminated with glass particles can cause complications in the patient	Nurse	194 (64.7)	106 (35.3)	χ^2=15.231
	Physician	237 (79.0)	63 (21.0)	p<0.001***
3. Particle scattering to buffer/fingers at glass ampoule opening	Nurse	40 (13.3)	260 (86.7)	χ^2=37.427
	Physician	104 (34.7)	196 (65.3)	p<0.001***
4. Large volume ampoules cause more glass particle contamination than small volume ampoules	Nurse	144 (48.0)	156 (52.0)	χ^2=11.312
	Physician	185 (61.7)	115 (38.3)	p<0.001***
5. Using a needle with a small lumen diameter prevents glass particles from being drawn into the syringe	Nurse	139 (46.3)	161 (53.7)	χ^2=12.387
	Physician	182 (60.7)	118 (39.3)	p<0.001***
6. The diameter of the needle is effective in reducing the passage of glass particles	Nurse	92 (30.7)	208 (69.3)	χ^2=3.356
	Physician	72 (24.0)	228 (76.0)	p=0.067
7. Presence of micro-sized glass particles in the medicine drawn from the ampoule to the syringe	Nurse	102 (34.0)	198 (66.0)	χ^2=21.285
	Physician	158 (52.7)	142 (47.3)	p<0.001***
8. Preventing from giving glass particles with the medicine to the patient	Nurse	131 (43.7)	169 (56.3)	χ^2=33.043
	Physician	201 (67.0)	99 (33.0)	p<0.001***

*p<0.05; **p<0.01; ***p<0.001, χ2: Chi-Square

Table 4. Distribution of correct answers to the questions in terms of number of ampoules used

Questions about glass particle contamination and the using of filter needles	Number of ampoules used	False	True	P-Value
		n (%)	n (%)	
1. Micro glass particle contamination occurs when opening the ampoule	≤ 50	107 (26.5)	297 (73.5)	χ^2=2.201
	≥ 51	41 (20.9)	155 (79.1)	p=0.138
2. Medicine contaminated with glass particles can cause complications in the patient	≤ 50	68 (22.7)	231 (77.3)	χ^2=0.150
	≥ 51	38 (24.4)	118 (75.6)	p=0.699
3. Particle scattering to buffer/fingers at glass ampoule opening	≤ 50	297 (73.5)	107 (26.5)	χ^2=1.728
	≥ 51	134 (68.4)	62 (31.6)	p=0.189
4. Large volume ampoules cause more glass particle contamination than small volume ampoules	≤ 50	110 (27.2)	294 (72.8)	χ^2=7.064
	≥ 51	34 (17.3)	162 (82.7)	p<0.008**
5. Using a needle with a small lumen diameter prevents glass particles from being drawn into the syringe	≤ 50	239 (59.2)	165 (40.8)	χ^2=9.341
	≥ 51	90 (45.9)	106 (54.1)	p<0.002**
6. The diameter of the needle is effective in reducing the passage of glass particles	≤ 50	230 (56.9)	174 (43.1)	χ^2=5.851
	≥ 51	91 (46.4)	105 (53.6)	p<0.016*
7. Presence of micro-sized glass particles in the drug drawn from the ampoule to the syringe	≤ 50	125 (30.9)	279 (69.1)	χ^2=8.102
	≥ 51	39 (19.9)	157 (80.1)	p<0.004**
8. Preventing from giving glass particles with the drug to the patient	≤ 50	191 (47.3)	213 (52.7)	χ^2=7.834
	≥ 51	59 (35.2)	127 (64.8)	p<0.005**

*p<0.05; **p<0.01; ***p<0.001, χ2: Chi-Square

The participants had good level of knowledge for their responses to the question (76%) "particle scattering to buffer/fingers at glass ampoule opening", while they had poor knowledge level for the question (28.2%) “medicine contaminated with glass particles can cause complications in the patient" (Table 2).

There was no filter needle or filter metal/plastic cannula in any department where the healthcare professionals worked. Furthermore, 99.8% of healthcare professionals indicated that there was no procedure about the use of filter needles to prevent glass particle contamination in the departments they worked, or they did not know if there was any. Correct answers from healthcare professionals to the questions were compared based on profession, number of ampoules used, glass particle contamination and use of filter needles. In the study, significant differences were found between the correct answers to some questions (p <0.05) (Table 3, Table 4).

While there were statistically significant differences

between correct answers of healthcare professionals to the 1st question according to their profession ($p < 0.05$), there were highly significant differences between their correct answers to the 2nd, 3rd, 4th, 5th, 7th and 8th questions ($p < 0.001$). It was determined that nurses gave more correct answers to the questions compared to physicians. It was observed that nurses generally had moderate and good knowledge about glass particle contamination and the use of filter needles (Table 3). The mean number of glass ampoule medicines used per day in the department where healthcare professionals worked caused a statistically significant difference between correct answers to the 5th and 8th questions ($p < 0.05$) and a highly statistically significant difference between correct answers to the 3rd, 4th, 6th and 7th questions ($p < 0.01$). Healthcare professionals working in departments where an average of 50 or more glass ampoule medicines were used per day had a higher rate of correct answers and generally had moderate and good knowledge (Table 4).

DISCUSSION

Glass ampoule medicines have been used in medical treatment for many years. While ampoule medicines are broken at the neck and opened, a large number of particles are formed and spill into the medicine content, which causes contamination (Erkoc Hut & Bayir, 2017; Carraretto et al., 2011; Lee et al., 2011; Yorioka, Oie, & Kamiya, 2009; Kawasaki, 2009; Lye & Hwang, 2003; Sabon et al., 1989). It is of great importance to raise awareness of healthcare professionals about the formation of micro- and macro-sized glass particles during the preparation of glass ampoule medicines for treatment and to take measures to avoid administering the contaminated medicine to the patient. Contamination can be easily recognized since macro-sized glass particles are visible to the naked eye. In this case, the medicine is destroyed without use (Sogut & Erkoc Hut, 2022). However, micro-sized glass particles cannot be seen with the naked eye since they are small enough to require a microscope to be seen. Therefore, contamination is an important problem (Erkoc Hut & Yazici, 2021). In the results of the study, it was remarkable that the mean age of healthcare professionals was 32.08 ± 6.66 years and that the mean duration of professional experience was 7.40 ± 6.76 years. In the hospital where the study was conducted, the workload increased due to the COVID-19 pandemic and healthcare professionals occasionally were on sick leave due to being infected. Moreover, the fact that employees over the age of 65 were declared a risk group by the government and granted leave of absence due to pandemic measures may also have affected the results of the study.

In the study by Erkoc et al., the mean number of glass ampoule medicines used in the clinics per day was mostly 20 or more and 34.3% of the nurses opened the ampoules without using any protective materials (Erkoc et al., 2015). In this study, the mean number of glass ampoule medicines used per day, and opening the ampoules with cotton, sponge and similar material without supporting the ampoule neck were found to be quite high, which may have been affected by the crowdedness of the hospital where the study was conducted. Furthermore, the increase in the workload of healthcare professionals due to the COVID-19 pandemic may have affected the results of the study. In this study, most healthcare professionals (75.3%) knew that while glass ampoule medicines are being prepared for administration, micro-sized glass particles form while opening them by breaking and spill into the medicine content causing contamination. In a study conducted by Harmon, a training program for the use of filter needles was prepared for anesthesiologists and anesthesia nurses, and pre-test and post-test evaluations were performed. It was reported that before training, 16% of the participants always used filter needles while preparing medicines for treatment, while 40% of them did not have filter needles in the medicine preparation area. However, it was demonstrated that with the training, there was an increase in the positive approach of the participants regarding the use of filter needles (Harmon, 2014). In our study, it can be said that healthcare professionals had a high level of knowledge about glass particle contamination of the medicine content when opening glass ampoule medicines by breaking. The fact that the majority of them had an undergraduate

education or higher is thought to have affected their rate of following the literature for professional development.

The study revealed that most healthcare professionals do not know that complications may occur as a result of administering medicines with glass particle contamination to the patient. It is reported in the literature that as a result of parenteral administration of glass ampoule medicines, various inflammatory effects and some pathological changes such as granuloma formations occur in the body and lead to complications that damage various organs (Zabir, Choy, & Rushdan, 2008; Heiss-Harris & Verklan, 2005; Preston & Hegadoren 2004; Sabon et al., 1989). In some studies, it was demonstrated that medicines contaminated with glass particles reached the cells, tissues and organs and caused inflammatory reactions, occluded capillaries and caused embolism and thrombus (Joo, Sohng, & Park, 2016; Preston & Hegadoren, 2004; Lye & Hwang, 2003; Puntis et al., 1992; Turco & Davis, 1971). Based on this information, it is thought-provoking that ampoule medicines are still used intensively today. The results of the study are an important resource indicating healthcare professionals need to be informed in more detail about the subject. It is considered that there is a need to raise awareness.

In the study, the majority of healthcare professionals indicated that glass particles were scattered on the buffer support or finger surface that came into contact with the neck when opening ampoules. This result suggests that glass contamination may have occurred in the contents of some medicines. However, healthcare professionals may think that these glass particles only scatter on the buffer that comes into contact with the ampoule neck. No study in this regard could be found in the literature. It is likely that glass particles spill into the medicine content and contaminate the medicine during the opening of medicine ampoules by breaking (Carraretto et al., 2011; Lee et al., 2011; Lye & Hwang, 2003; Sabon et al., 1989). When macro glass particles falling into the ampoule are seen, the medicine is not used and the ampoule is completely discarded. However, spilling of micro glass particles into the ampoule cannot be seen with the naked eye and this poses a threat to patient safety (Lee et al., 2011; Lye & Hwang, 2003). In this respect, if glass particles are seen in the area where the ampoule neck is held, it should not be forgotten that glass particle contamination may have occurred in the medicine content.

In the literature, it was reported that medicine ampoules with a volume of 20 ml cause more glass particle contamination, while medicine ampoules with a volume of 1 ml cause less glass particle formation compared to ampoules with a larger volume (Carbone-Traber & Shanks, 1986). In the study, nearly half of the healthcare professionals argued that large-volume ampoules may cause more glass particles to spill into the medicine content while opening compared to small-volume ampoules. No study evaluating the knowledge of healthcare professionals about this issue could be found in the literature. In the study, it was observed that the green needle tip was most frequently used to draw medicines from glass ampoules into the syringe. However, as the lumen diameter increases, it allows more glass particles to pass into the chamber of the syringe. It is known that 23 G size needles allow fewer glass particles to pass since they have a smaller diameter; however, 18 G size needles allow more glass particles into the chamber of the syringe since they have a larger diameter (Harmon, 2014; Zabir, Choy, & Rushdan, 2008; Lye & Hwang, 2003; Carbone-Traber & Shanks, 1986). In the hospital where the study was conducted, healthcare professionals use the materials available in their departments for medicine administrations. It was observed that 21 G size green needle tips were mostly found in the departments. Therefore, the fact that the green needle tip was most frequently used for drawing ampoule medicines may have affected the results of our study. Furthermore, most of the healthcare professionals thought that the lumen diameter of the needle tip used may reduce the drawing of glass particles into the syringe. In accordance with these results, it can be said that healthcare professionals did not have detailed information about the subject.

The use of a filter needle or a syringe filter during the preparation of glass ampoule medicines for administration reduces the amount of glass particle

contamination, and it is recommended to primarily use a filter needle to minimize the harm that may occur to the patient (Erkoc Hut & Yazici, 2021; Preston, & Hegadoren, 2004). In the study, a small number of healthcare professionals had syringe filters or inline filter apparatus in the departments they worked. Some healthcare professionals emphasized that there was a syringe filter in the kit of an antifungal medicine in the clinic and that they used this filter while preparing the medicine for treatment. In the study, it was revealed that there was no filter needle or filter metal/plastic cannula in any of the departments. Furthermore, there was no procedure regarding the use of filter needles in the departments. With regard to the use of filters to reduce the passage of glass particles, institutions such as the American Society of Health System Pharmacists and the Infusion Nurses Association indicate the need to use filter needles with a pore opening of 5 µm (Infusion Nurses Society, 2016; American Society of Health-System Pharmacists, 2014). In the study by Harmon, while 72% of the participants indicated that they did not have knowledge about any policy or standard regarding glass ampoule medicines and the use of filter needles in hospitals, 65% indicated that they were not aware of any institution or organization with standards for the use of filter needles with ampoules (Harmon, 2014). No study about the use of filter needles in our country could be found. The fact that procedures for the use of filter needle have not become widespread in our country may have affected the results of our study.

In the study, there was a significant difference between variables such as profession, professional experience, number of ampoules used in the clinic and educational status among the sociodemographic characteristics of healthcare professionals, and their answers to some of the questions about glass particle contamination and the use of filter needles. It was observed that nurses gave more correct answers to the questions compared to physicians. Nurses working in health institutions are responsible for parenteral medicine administration, intravenous, intramuscular and subcutaneous medicine administrations at the request of the physician (Official Newspaper of the Republic of Turkey, 2011). Furthermore, the fact that intravenous administration was the most common method in the study may also have affected this result, which may be due to the fact that nurses made more observations on the subject. Professional experience and the number of ampoules used in the clinic can be considered as important factors for the implementation of interventions to prevent particle contamination. In the study, a significant difference was found between the number of glass ampoules used in the departments where healthcare professionals work and the answers to some questions about knowledge level. There were less correct answers to the questions about the scattering on the buffer or fingers while supporting the ampoule neck, the formation of glass particles according to different ampoule volumes, the use of small lumen diameter needle tip for the transfer of contaminated medicines, and interventions to prevent the administration of micro glass particles to the patient with the medicine in the group using mean 50 or less ampoules per day was 50 compared to the group using 50 or more ampoules. In the study conducted by Harmon, 91% of the participants indicated that they used an average of 1-15 glass ampoules per day (Harmon, 2014). The high number of glass ampoules used in the departments where healthcare professionals worked indicates that they have more information about particle contamination.

In the study, a significant difference was found between training status about the use of filter needles of healthcare professionals and the answers to some questions about their knowledge level. In the study, healthcare professionals who had not received any training gave significantly more incorrect answers to the questions about the spillage of glass particles into the medicine when opening ampoules by breaking, whether contamination caused complications, formation of glass particles according to different ampoule volumes, and the use of small lumen diameter needle tip for the transfer of contaminated medicine. The study showed that the number of people trained in the use of filter needles was low; however, the number of wrong answers to the questions was parallel to this. Among the healthcare professionals participating in the

study (n = 36) who indicated that they received training about glass particle contamination and the use of filter needles, while 44.4% of them gained this information during their school education, 16.7% gained this information from the articles/books they read, 19.4% gained this information from friend chats, and 19.4% gained this information through in-house training. In the study by Harmon, while the majority of the participants (67%) were trained about the use of filter needles in the institution where they worked, 2% learned it from course books, 2% learned it from laboratory experiments, 16% learned it in all these areas together, and 12% did not learn from any of these areas (Harmon, 2014). The absence of filter needles in the departments of the hospital where the study was conducted may have affected the results of our study. Training about glass particle contamination and the use of filter needles is important in clinics.

CONCLUSION

In conclusion, healthcare professionals had moderate knowledge about glass particle contamination and the use of filter needles. Variables such as profession, the number of ampoules used in the clinic, and educational status may affect the level of knowledge. However, the departments where healthcare professionals worked did not have an effect on their level of knowledge. It is necessary to improve the awareness of physicians who plan patient prescriptions and nurses who administer medicines to patients in this regard. It is of great importance to establish clinical procedures for the use of filter needles during the preparation of glass ampoule medicines for administration in healthcare institutions. Findings inform to stresses the need to raise awareness in terms of reducing glass particle contamination in parenteral medicine administration. It is recommended to plan education for healthcare professionals about glass particle contamination and the use of filter needles in order to draw attention to patient safety.

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Conflict of Interest

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