



Needlestick and Sharps Injuries Among Operating Room Nurses, Reasons and Precautions

Ameliyathane Hemşirelerinin Kesici-Delici Aletler ile Yaralanma Durumu, Nedenleri ve Önlemleri

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ABSTRACT

Objective: This study was carried out to determine the needlestick injuries (NSI) of the operating room nurses with penetrating and sharp tools, the causes of the injury and the precautions taken to prevent the injury.

Methods: A descriptive and cross-sectional study was conducted with the participation of 463 volunteer nurses from 27 different hospitals in İstanbul, Turkey. After obtaining the ethics committee, institutions and volunteer permissions of the study, the data were collected with two data collection forms formed in line with the literature knowledge and expert opinions. The data were analyzed using IBM SPSS 22.0 program and $p < 0.05$ was significance value.

Results: Participants were 18-61 years old, (mean: 35.9 ± 0.84), 63.7% had bachelor's degrees and above, 80.8% of operating room nurses were graduated from nursing program. 68.9% of the participants reported that they had lived at least once during their working life. There were significantly different for NSI ($p < 0.05$) women, married and had low educational levels, working in university hospitals with deep invasive intervention and using protective equipment. Participants reported that 54.8% of the injuries were performed in the right hand and the primary cause was exchanging instruments between nurse and surgeon, the secondary was assisting surgeon. Most of the participants (37.1%) were injured by the suture material. The most common NSI encountered operating theaters were pediatric surgery, cardiovascular surgery, thoracic surgery and general surgery.

ÖZ

Amaç: Bu araştırma, ameliyathane hemşirelerinin delici kesici aletlerle yaralanma (DKAY) durumunu, yaralanma nedenlerini ve yaralanmadan korunmak için aldıkları önlemleri belirlemek amacıyla yapıldı.

Yöntemler: Tanımlayıcı ve kesitsel nitelikteki araştırma, Türkiye'nin İstanbul ilinin 27 farklı hastanesindeki 463 gönüllü hemşirenin katılımı ile yapıldı. Araştırmanın verileri, etik kurul, kurum ve gönüllü izinleri alındıktan sonra literatür bilgisi ve uzman görüşleri doğrultusunda oluşturulan farklı iki veri toplama formu ile toplandı. Veri analizinde IBM SPSS 22.0 programı kullanılarak anlamlılık $p < 0,05$ düzeyinde değerlendirildi.

Bulgular: Katılımcıların, 18-61 yaş (ortalama: $35,9 \pm 0,840$) arasında, %63,7'sinin lisans ve lisansüstü eğitim düzeyinde olduğu, %80,8'inin hemşire unvanı ile ameliyathane hemşiresi olduğu belirlendi. Katılımcıların %68,9'u çalışma hayatları boyunca en az bir kez DKAY yaşadığını bildirdi. DKAY; kadın, evli ve eğitim düzeyi düşük, devlete bağlı üniversite hastanelerinde çalışan, koruyucu ekipman olanağı yeterli sağlanmayan/kullanmayan katılımcılarda daha fazlaydı, fark istatistiksel olarak anlamlıydı ($p < 0,05$). Katılımcılar DKAY'nin nedeninin çoğunlukla cerrahi alet alışverişi/yardım edici davranışlar sırasında yaşanabildiğini bildirdi. DKAY yaşayan katılımcıların sağ elden yaralandıkları (%54,8), en fazla yaralanmanın %37,1 ile suture materyalinden kaynaklandığı bulundu. Yaralanmanın en fazla yaşandığı ameliyathaneler sırasıyla çocuk cerrahisi, kardiyovasküler cerrahi, göğüs cerrahisi ve genel cerrahiydi.

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Conclusion: The results of the research show that NSI is an important problem related to healthcare workers' safety in operating theaters.

Keywords: Operating room, operating room nurses, needlestick injuries, risk factors, prevention

Sonuç: Araştırma sonuçları, DKAY'nin ameliyathane sağlık çalışanlarının güvenliğini etkileyecek kadar önemli bir sorun olduğunu göstermektedir.

Anahtar Sözcükler: Ameliyathane, ameliyathane hemşireleri, delici kesici alet yaralanmaları, risk faktörleri, önlem

Introduction

Needlestick injury (NSI) is among the leading occupational accidents and risks that healthcare workers are exposed to (1). Such injuries are seen as an important problem that most of the health workers face at least once during their professional life (2). NSI is considered as a risk factor especially for the surgical team in terms of employee health (3). Operating rooms within the hospital are the most risky places for NSI. Studies have shown that the health workers most exposed to NSI are nurses and physicians (4-6). It has been reported that NSI can be experienced for many reasons, especially the intensity of the intraoperative process, stress and factors related to the employees (7).

The Centers for Disease Control and Prevention pointed out that contact with blood and body fluids and its effects were mostly seen in nurses (1,8). In the 2018 report of the EPINet™ database prepared for the surveillance of NSI and blood-borne infections, it was reported that NSI occurred mostly in operating rooms and in nurses among all healthcare workers (4,9). According to the data of the European Agency for Safety and Health at Work, approximately 1 million injuries occur in healthcare workers each year in Europe caused by injectors alone (10). Research emphasizes that the measures to be taken and the adoption of safety practices can reduce the NSI by 80% (11,12).

Although it is known that protective measures are necessary in the researches, it is reported that infectious diseases continue to be transmitted under the name of "work accident". When the studies conducted in this area are examined, it is seen that there are suggestions that it should be questioned whether the rate of NSI of nurses decreases in the face of developing science and technology (13-17).

The present study was carried out to determine the conditions of operating room nurses that caused NSI, the precautions they took to prevent injury, and to draw attention to the importance of this issue in the light of the literature.

Within the scope of the research purpose, answers were sought to the following questions;

1. What is the prevalence of NSI among operating room nurses?
2. Is NSI related to the sociodemographic characteristics of operating room nurses?
3. Is NSI related to the working conditions of operating room nurses?

4. What are the precautions taken regarding NSI in the conditions where the operating room nurses work?

Methods

The Universe and Sample of the Research

The "general universe" of the study, which was planned as a descriptive and cross-sectional study, was represented by the operating room nurses of 220 hospitals in İstanbul, including university, state, educational research and private hospitals (18). Among these hospitals, the "study universe" of the research was chosen. In the literature, attention is drawn to the risk of NSI in healthcare workers in training and research hospitals (19). Therefore, the "study universe" was composed of operating room nurses of training and research hospitals, state hospitals and university hospitals (n=1266). Since the presented research was a master's thesis, it had to be completed within a certain time, so the research was limited to the İstanbul European region. Thus, the study population consisted of 570 operating room nurses working in 27 hospitals. Since it was aimed to reach the whole research universe, no sample calculation was made. While collecting the data, nurses who were in surgery (n=25; 4.38%), who did not want to participate in the study (n=47; 8.24%) or who were sick (n=35; 6.13%) were excluded from the study. The research was completed with a participation rate of 81.2%. Thus, a total of 463 nurses participated in the study.

Data Collection Tools

Data were collected with a questionnaire developed in line with the literature (20-23) and expert opinions. Survey form included 42 closed questions that determined the socio-demographic characteristics of the operating room nurses, their situations and reasons for NSI, and their and their institutions' approaches to the measures taken to prevent NSI. In order to evaluate the clarity of the questions, a preliminary study was carried out with approximately 10% of the sample number (n=47). After the preliminary study, the questions in the data collection form were rearranged and it was decided to use the revised form.

Data Collection

Methods based on "self-report" were used in data collection.

After the necessary permissions were completed, the operating rooms of the hospitals where the research would be conducted were visited according to a pre-planned schedule (between 23.01.2017 and 28.08.2017). Information about the research was given by interviewing with the operating room nurse in charge of each hospital about the questionnaire forms, the

importance of the study to be conducted and ethical permissions. Questionnaires and voluntary consent forms were delivered to the nurses. A second visit was made by contacting the nurse in charge within 10-15 days to collect the forms distributed by the researcher.

Evaluation of Data

Data were analyzed in IBM SPSS 22.0 package program. Statistical significance of the data was analyzed with Pearson Chi-Square Test, Pearson Correlation Test, Fisher's Exact test, t-Test, and f-test (ANOVA) according to the distribution status of the data. Significance was evaluated at the 95% confidence level and at the $p < 0.05$ level.

Ethical Considerations

The study was approved by the Bezmi Alem Vakıf University Non-interventional Clinical Research Ethics Committee (29.11.2016 8/93). Institutional permissions were taken from the rectors of university hospitals, and from the general secretariats of the public hospitals to which they were affiliated. Voluntary participation consent was obtained from the participants in writing.

Results

In this section, there are introductory and comparative findings obtained with the aim of assessing the participants' NSI status.

In the present study, it was determined that 80.8% of the participants were female, 19.2% were male, 57% were married, 42.8% were between 29-39 years old (mean age 35 ± 0.840), and 63.7% had undergraduate or higher education level. It was determined that 80.8% of the operating room nurses graduated from a nursing program, 41.7% worked in training and research hospitals, and 53.6% had 7 years or more of operating room nursing experience. In addition, it was determined that 68.9% of the participants reported that they had experienced NSI (Table 1).

Table 2 shows some of the characteristics of the participants about NSI. Of the participants 28.3% stated that they experienced NSI during the exchange of surgical instruments, 16.3% during assisting the surgeons, and 15.3% during collecting and counting of surgical instruments. It was reported that injuries were most common in the hand (96.8%), with 54.8% of the injuries occurring in the right hand. In 37.7% of the nurses suture material and in 28.2% scalpel were shown as the instrument causing injury.

When the socio-demographic characteristics of the participants were compared with NSI, it was found that female participants were more likely to encounter NSI than male participants ($p = 0.007$), and that married participants were more likely to encounter NSI than singles ($p = 0.002$). Although the frequency of NSI increased with increasing age, there was no statistically significant difference ($p = 0.607$). As the level of education increased, frequency of NSI also increased and the difference was statistically significant ($p = 0.016$) (Table 3).

Table 4 shows the comparison of the characteristics of the participants with NSI. In the operating room nurses of state university hospitals, NSI was less than the others, but the difference was not statistically significant ($p = 0.938$). Although the nurses working in the pediatric surgery (81.3%), thoracic surgery and cardiovascular surgery (78.2%), and general surgery (77.1%) operating rooms reported more NSI compared to the other operating rooms, the difference was not statistically significant ($p = 0.651$).

It was observed that as the working years as an operating room nurse, the duration of working hours in a shift, and the average time spent in surgery increased, the frequency of NSI increased ($p = 0.01$), and working in a mixed shift system was significantly related with NSI ($p = 0.001$).

NSI was less in healthcare workers ($n = 58$) employed as operating room nurses than in nurses. However, this difference was not statistically significant ($p = 0.235$).

Table 5 shows the comparison of the participants' NSI status according to the security measures taken. Difficulty in finding protective equipment showed an insignificant relationship with the NSI status ($p = 0.887$). However, as the use of protective equipment increased, it was observed that the NSI decreased and the difference was statistically significant ($p = 0.001$). When the precautions the participants took against NSI were examined, it was determined that the practices such as the use of double gloves and control of patient serology did not make a difference for participants with and without NSI ($p < 0.05$).

Discussion

In the present study, the fact that the majority of the participants are young, married, had a high level of education and were working in the operating room for a long time suggested that this group consisted of dynamic and high-conscious individuals with a regular family life. It could be concluded that the presented study was similar to the studies published in the national and international literature in terms of socio-demographic characteristics (2,24-29). In addition, the fact that the majority of the participants were state hospital employees might be related to the fact that the participants preferred institutions with more personal rights, or it might be due to the selection of samples.

According to OECD (Organization for Economic Co-operation and Development) 2018 data, the number of nurses providing care to every 1000 citizens was 17.8 in Norway, 17.2 in Switzerland, 14.8 in Iceland, while it was 2.1 in Turkey, which was far behind the OECD average (30). In the presented study, the fact that most of the nurses worked in random units and mixed-shift system in the operating room suggested that nurses worked under hard conditions according to OECD recommendations and their conditions regarding employee safety were risky. In the study conducted by Kan (31), it was reported that 29.4% of the operating room nurses were distracted at the 4th hour, that the distraction peaked at the 6th hour, and that there was a relationship between prolonged surgeries and NSI in 94.1% of the operating

Table 1. Descriptive characteristics of the participants (n=463)

Characteristics		n	%
Gender	Female	374	80.8
	Male	89	19.2
Age*	18-28	169	36.5
	29-39	198	42.8
	40 or above	96	20.7
Marital status	Married	264	57.0
	Single	199	43.0
Education	High school or undergraduate	168	36.3
	Graduate or postgraduate	295	63.7
Occupation	Nurse	374	80.8
	Participants other than nurses **	89	19.2
Institution	Training and research hospital	193	41.7
	Foundation affiliated university hospital	107	23.1
	State university hospital	98	21.2
	Public hospital	65	14.0
Department***	Gynecological surgery and urology	118	14.3
	Ear nose throat and plastic surgery	115	14.0
	General surgery	105	12.7
	Orthopedics	99	12.0
	Working in all departments	92	11.2
	Thoracic surgery and cardiovascular surgery	87	10.6
	Neurosurgery	54	6.6
	Pediatric surgery	48	5.8
Shift	Day shift only	180	38.9
	Mixed day or night	283	61.1
Average working time per shift	8-10 hours	344	74.3
	11-13 hours	82	17.6
	14 hours or above	37	8.1
Average length of stay in a surgery	1-2 hours	76	16.4
	3-4 hours	221	47.7
	5-6 hours	117	25.3
	6 hours or above	49	10.6
Operating room nursing experience	1-6 years	215	46.5
	7-12 years	99	21.4
	13 years or above	149	32.2
Needlestick injury status	Yes	319	68.9
	No	144	31.1

*The oldest age is 61, the mean age is 35.924±0.840

**Operating room technician (n=33), emergency medical technician (n=22), health officer (n=14), paramedic (n=5), perfusionist (n=1), laboratory technician (n=3), prosthesis-orthotics Technician (n=2), midwife (n=2), not specifying the professional title (n=7)

***Participants gave more than one answer.

****Emergency surgery (n=39), ophthalmology operating room (n=39), supervisor (n=27), robotic surgery (n=1)

room nurses (31). The NSI rates of nurses in the present study (Table 1) were similar to some developing countries, suggesting that operating room nurses expected solutions for similar risks

internationally (32). Zhang et al. (33) reported the rate of NSI as 84.6% in China, Kasatpibal et al. (2) 71.5% in Thailand, Yazar et al. (34) 65.8%, and Benli et al. (35) 77.9% (33). It is

Table 2. Some characteristics of the participants about needlestick injury

Needlestick injury characteristics		n	%
Causes of injury*	While exchanging drilling-cutting tool	279	28.3
	While assisting the surgeon	161	16.3
	During the collection and counting of instruments	151	15.3
	When using an injector	117	11.9
	In emergency surgeries/events	105	10.7
	While preparing the surgery table	56	5.7
	During the use of the Sharp-Box	49	5.0
	While controlling medical wastes in surgical instrument loss	27	2.7
	During washing and packaging of surgical instruments	22	2.2
	Other (responsible nurse, robotic surgery...)	18	1.8
Injured organ*	Right hand	256	54.8
	Left hand	196	42.0
	Other (arms, head, neck, trunk, eye ...)	15	3.2
Injuring instrument*	Suture material	245	37.7
	Lancet	183	28.2
	Injector/IV catheter	144	22.2
	Other**	78	12.0
Provision of protective equipment	Always having trouble	62	13.4
	Sometimes can't find	180	38.9
	Available whenever	221	47.7
The use of protective equipment in surgeries	Always	209	45.1
	Sometimes	88	19.0
	Never	13	2.8
	Only in infected cases	153	33.0
Use of double gloves during surgery	In all surgeries	166	35.9
	Not used	188	40.0
	Used during preoperative skin asepsis	45	9.7
	Other***	64	13.8
Checking patient serology before surgery	Always	284	61.3
	Sometimes	143	30.9
	Never	36	7.8

* Participants gave more than one answer.
 **It shows injury with Kirschner wire (n=4), laparoscopic trocar guide (n=2), chainsaw (n=1), root cannula needle (n=1), drain guide (n=1), (n=69) did not report in writing what he/she was injured with.
 ***Infected cases (n=44), Orthopedic surgery (n=20)

controversial that gender is a risk factor for NSI (32-36). Afridi et al. (36) in Pakistan compared the gender of participants (35.8% male and 64.2% female) in terms of NSI and reported that gender did not show a significant difference in terms of NSI. In the present study, the reason for the significantly higher NSI in females was the lower number of male participants. With the increase in age, it is expected that the NSI will decrease as the experience, education level and knowledge increase. Educational level may not be a determining risk factor for NSI, as it does not always indicate skill level in clinical practice. However, education

can provide awareness of the problem and accelerate finding solution by organizing against the problem (37). In the study presented, it is believed that trained and experienced nurses were more likely to face DKAY because they participated in operations more due to their age and faced risk (Table 3).

In the present study, when the causes of NSI were examined, it was thought that the “hands-free” technique was not used effectively, especially in the operating rooms, as the participants reported that they were injured by instruments with stinging and cutting

Table 3. Comparison of participants' socio-demographic characteristics with needlestick injury status (n=463)

Socio-demographic characteristics		Needlestick injury status				
		Yes			No	
		n	%	p	n	%
Gender	Female	268	71.7	0.007	106	28.3
	Male	51	57.3		38	42.7
Age	18-28 years	112	66.3	0.607	57	33.7
	29-39 years	138	69.7		60	30.3
	40 years or above	69	71.9		27	28.1
Marital status	Married	197	74.6	0.002	67	25.4
	Single	122	61.3		77	38.7
Education	High school or undergraduate	107	63.6	0.016	61	36.4
	Graduate or postgraduate	212	68.9		83	31.1

Table 4. Comparison of the participants' working life characteristics with needlestick injury status (n=463)

Working life characteristics		Needlestick injury status				
		Yes			No	
		n	%	p	n	%
Institution	Training and research hospital	135	69.9	0.938	58	30.1
	Foundation affiliated university hospital	74	69.2		33	30.8
	State university hospital	65	66.3		33	33.7
	Public hospital	45	69.2		20	30.8
Department	Gynecological surgery and urology	86	72.9	0.651	32	27.1
	Ear nose throat and plastic surgery	85	73.9		30	26.1
	General surgery	81	77.1		24	22.9
	Orthopedics	71	71.7		28	28.3
	Working in all departments	67	72.8		25	27.2
	Thoracic surgery and cardiovascular surgery	68	78.2		19	21.8
	Neurosurgery	41	75.9		13	24.1
	Pediatric surgery	39	81.3		9	18.7
Operating room nursing experience	1-6 years	134	62.3	0.01	81	37.7
	7-12 years	70	70.7		29	29.3
	13 years or above	115	77.2		34	22.8
Shift	Day shift only	109	60.6	0.001	71	39.4
	Mixed day or night	210	74.2		73	25.8
Average working time per shift	8-10 hours	235	68.3	0.367	109	31.7
	11-13 hours	84	70.6		35	29.4
Average length of stay in a surgery	1-2 hours	49	64.5	0.222	27	35.5
	3-4 hours	146	66.1		75	33.9
	5-6 hours	86	73.5		31	26.5
	6 hours or above	38	77.6		11	22.4
Occupation	Nurse	261	69.8	0.235	113	30.2
	Participants other than nurses	58	65.2		31	34.8

Table 5. Comparison of the participants' needlestick injury status according to the security measures taken (n=463)

Security measures		Needlestick injury status				
		Yes			No	
		n	%	p	n	%
Provision of protective equipment	Always having trouble	44	71.0	0.887	18	29.0
	Sometimes can't find	122	67.8		58	32.2
	Available whenever	153	69.2		68	30.8
The use of protective equipment in surgeries	Always	126	60.3	0.001	83	39.7
	Sometimes	59	67.0		29	33.0
	Never	9	69.2		4	30.8
Use of double gloves during surgery	Only in infected cases	125	81.7	0.296	28	18.3
	In all surgeries	111	66.9		55	33.1
	Not used	137	72.9		51	27.1
Checking patient serology before surgery	Used during preoperative skin asepsis before surgery	32	71.1	0.743	13	28.9
	In orthopedic surgeries and infected cases	39	60.9		25	39.1
	Always	193	68.0		91	32.0
Checking patient serology before surgery	Sometimes	102	71.3	0.743	41	28.7
	Never	24	66.7		12	33.3

properties while exchanging surgical instruments and helping the surgeon. Penetrating tools used in the operating room are generally capable of causing injuries such as cutting, puncturing, and scratching (37,38). However, Stringer et al. (39) reported that the injury rate was 1.2% in surgeries using the “hands-free technique” and 4.0% in surgeries that did not use. In another study, Stringer et al. (40) reported that the “hands-free technique” and the visual materials used in the training of this technique were effective in reducing the NSI. Jagger and Perry (41) reported that the use of the same technique was effective in their study. Considering the studies on the properties of the injurious agent; Kürtünlü (42) showed that suture material (41.5%) and scalpel (38.4%), Mohammad (43) injector needles (45%) and surgical sutures (30%), Lakbala et al. (27) sutures (59%), Hajipour (44) sutures (43.4%), and Wada et al. (26) sutures (48.3%) were the most common causes of injury. The fact that the majority of the injured participants in the present study experienced injury during pediatric and cardiac surgery operations might be related to the physical properties of the instruments used in these operations and the surgical technique. In these surgeries, small suture materials that force hand manipulation are used or deep invasive procedures are performed.

It has been suggested that while double-layered and different colored indicator gloves used in surgery reduce the risk of NSI, wearing single-colored standard gloves on each other creates an unnecessary sense of security (45). Makama et al. (46) reported that 15.2% of the gloves worn in single layer, 27.5% of the outer part of the gloves worn in double layer and 1.2% of the inner part of the gloves worn in double layer were not damaged.

Demircay et al. (47) reported that the outer part of 18.4% and the inner part of 8.4% of the double-layered gloves were not damaged. Guo et al. (48) reported that 11.3% of the outer part of gloves that were worn double layer were torn while the inner part was intact, and that 8.9% of the gloves that were worn in one layer were torn (46-48). In the presented study, it was seen that double layer gloves were used in a rate which could not be underestimated. This situation might lead healthcare workers to more risky interventions by feeling more secure and might increase the rates of NSI.

According to the findings of the study presented, the nurses were unable to realize standard protection measures related to NSI and they reported that they had difficulties in finding equipment to protect against NSI. This might be due to the characteristics of the hospitals where the participants worked, because while private hospitals had to live on their own capital, state hospitals might have difficulty in supplying materials due to excessive patient load. In a study conducted by Özenir (49) in a private hospital in Turkey, it was reported that 79% of nurses had difficulty in accessing protective equipment.

Study Limitations

During the study, it was learned that different occupational groups (emergency medical technician, paramedic, midwife, perfusionist, prosthesis-orthotics technician, operating room technician) were employed under the name of operating room nurse in some institutions where the study was conducted (19.2%). Since these non-nurses were employed as operating room nurses, it was thought that it would be unethical to exclude

them from the sample, as they were considered to be at risk in terms of NSI. Discussing the results of these healthcare workers, who did not have nursing education, regarding NSI may have limited the observation of the nurses' injury status.

Unfortunately, many healthcare graduates are employed as nurses in hospitals for various reasons, although they do not graduate from nursing schools. In this case, examining and presenting these health workers' NSI separately may have correct results in many respects.

Conclusion

According to the findings of the study, the operating room nurses encounter a significant number of NSI. The conditions related to the institution where they work/employ rather than their sociodemographic characteristics play a prominent role in NSI. The fact that the majority of NSI is preventable indicates that institutional policies should change. It is recommended to investigate the causes and consequences of institutional sanctions in order to achieve the expected goals with experienced, highly educated nurses employed in the operating room.

Ethics

Ethics Committee Approval: The study was approved by the Bezmialem Vakıf University Non-interventional Clinical Research Ethics Committee (29.11.2016 8/93).

Informed Consent: Voluntary participation consent was obtained from the participants in writing.

Peer-review: Externally peer reviewed.

Authorship Contributions

Concept: M.D., Y.Y.S., Design: M.D., Y.Y.S., Data Collection or Processing: M.D., Analysis or Interpretation: M.D., Y.Y.S., Literature Search: M.D., Y.Y.S., Writing: M.D., Y.Y.S.,

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