Determination of the Knowledge Level of Surgical Intensive Care Nurses in Medical Device Induced Pressure Injury

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Abstract

Aim: The purpose of this study was to measure the level of knowledge and attitudes of nurses in surgical intensive care units (ICUs) about medical device-induced pressure injury.

Method: The cross-sectional study was conducted with 227 surgical intensive care nurses in Turkey between November 2022 and June 2023. "Nurse Introduction Form" and "Pressure Ulcer Knowledge Level Assessment Tool Scale" were used as data collection tools. Since the scale score averages did not comply with normal distribution, Mann Whitney U and Kruskal Wallis tests were used in the statistical analysis of the data.

Results: It was found that the majority of participants (n=227) were in the age range of 26-33 years (n=115), and 66.1% (n=113) had been working in the ICU for 1-5 years. 51.5% (n=117) of the participants reported having received training in medical device-related pressure injury. In the pressure ulcer knowledge level assessment tool, the mean of the "prevention of pressure ulcers" sub-dimension (mean: 4.74) was found to be the highest, while the total knowledge level score was 14.87±5.6 and it was found that the nurses had a moderate level of knowledge.

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ETHICAL STATEMENT: Before starting the study permission was obtained from the Non-Interventional Clinical Studies Ethics Committee of Marmara University Faculty of Health Sciences (Date: 29.12.2022 / Issue No: 137) and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Conclusion: The findings of the study indicated that nurses' knowledge of medical device-related pressure injuries was inadequate, but that their knowledge of pressure injury prevention increased with increasing levels of education.

Keywords: Pressure injury, nursing care, medical device, intensive care unit, pressure, knowledge.

Tıbbi Cihaz Kaynaklı Basınç Yaralanmasında Cerrahi Yoğun Bakım Hemşirelerinin Bilgi Düzeyinin Belirlenmesi

Öz

Amaç: Araştırma cerrahi yoğun bakım ünitelerinde çalışan hemşirelerin tıbbi cihaz kaynaklı basınç yaralanması bilgi tutum düzeylerini ölçmek amacıyla yapıldı.

Yöntem: Kesitsel tanımlayıcı olan araştırma, Türkiye genelinde Kasım 2022-Haziran 2023 tarihleri arasında çalışmaya katılan 227 cerrahi yoğun bakım hemşiresi ile yürütüldü. Veri toplama aracı olarak, "Hemşire Bilgi Formu", "Basınç Ülseri Bilgi Düzeyi Değerlendirme Aracı" kullanıldı. Verilerin istatistiksel analizinde ölçek puan ortalamaları normal dağılıma uymadığı için değerlendirmede Mann Whitney U testi ile Kruskal Wallis testleri kullanıldı.

Bulgular: Çalışmaya katılan katılımcıların (n=227) çoğunluğunun 26-33 yaş aralığında (n=115) olduğu, %66,1'inin (n=113) 1-5 yıldır yoğun bakımda çalıştıkları saptandı. Katılımcıların %51,5'i (n=117) tıbbi cihaz kaynaklı basınç yaralanmasıyla ilgili eğitim aldığını ifade etti. Basınç yarası bilgi düzeyi değerlendirme aracında "basınç ülserlerinin önlenmesi" alt boyutu (ortalama: 4,74) ortalaması en yüksek olarak bulunurken, toplam bilgi düzey puanı 14,87±5,6 olup hemşirelerin orta düzeyde bilgiye sahip oldukları bulundu.

Sonuç: Çalışma bulgularına göre yoğun bakım ünitesinde çalışan hemşirelerin tıbbi cihaz kaynaklı basınç yaralanması konusunda bilgi düzeyinin yeterli olmadığı ancak eğitim düzeyinin artmasıyla basınç yaralanması önleme bilgi düzeyinin arttığı saptandı.

Anahtar Sözcükler: Basınç yaralanması, hemşirelik bakımı, tıbbi cihaz, yoğun bakım ünitesi, basınç, bilgi.

Introduction

Medical device-induced pressure injuries (MDIPI) are injuries that develop during the application of a diagnostic or therapeutic device during hospitalization[1,2]. These injuries can result in a progressive pressure injury, even superficial, and can develop anywhere on the patient's body depending on the device application. Nurses play a crucial role in preventing MDIPI and knowing about them is essential to providing effective care. However, nurses' knowledge of MDIPI is inadequate, as several studies have shown[3,4]. To improve nurses' knowledge of MDIPI, hospitals are recommended to provide regular education and training programs for nurses. In addition, hospitals can implement evidence-based prevention strategies related to bundled care, which includes

interventions such as skin assessment, device selection, device/instrument repositioning, and education[5]. Understanding nurses' perceptions and experiences of MDIPI is also important to identify potential barriers to prevention and develop effective strategies to address them. By increasing nurses' knowledge and addressing potential barriers, hospitals can reduce the incidence of MDIPI and improve patient outcomes[2,4].

Nurses' knowledge and attitudes towards pressure injury prevention and management play a key role in reducing the incidence of pressure injuries. It is therefore known that a high level of knowledge among nurses is effective and important in improving the quality of care and preventing unnecessary costs[6].

The prevention and treatment of pressure injuries require a holistic approach to care. Because it affects the patient in many ways, a multidisciplinary team approach should be taken to the prevention and management of pressure injuries. The most effective member of the team is the nurse. The nurse is one of the permanent members of the multidisciplinary team and provides 24-hour care to the patient[7-9]. This study aimed to determine the level of knowledge of intensive care nurses about pressure injuries caused by medical devices.

Material and Methods

Type of Research: Designed as a cross-sectional study.

Place and Time of the Study: The study was conducted with 227 surgical intensive care nurses working in intensive care units of surgical units throughout Turkey between November 2022 and June 2023.

Population Sample of the Study: All nurses working in surgical ICUs (such as neurosurgery, cardiovascular surgery, surgery, anesthesiology and reanimation) of any hospital in Turkey constituted the population of the study. Participants were reached through the members of the Turkish Intensive Care Nurses Association. The study did not use sampling, and the study sample consisted of 227 critical care nurses working in surgical units who were informed of the study between November 2022 and June 2023 and who provided voluntary online consent to participate in the study.

Inclusion Criteria: Nurses who have worked in surgical ICUs for at least one year and continue to work.

Exclusion Criteria: Incomplete completion of data forms and working in ICUs that are not surgical units (such as coronary intensive care, neurology intensive care, internal intensive care).

Data Collection Method and Tools: Data was collected through data collection tools delivered to association members via the online platform. Structured, self-report-based "Nurse Introduction Form" and "Pressure Ulcer Knowledge Level Assessment Tool Scale" were used as data collection tools.

Nurse Identification Form: It is a form consisting of 19 questions prepared by the researchers by considering the literature[2,10-16]. The form includes questions about sociodemographic characteristics including gender, age, educational status, time of professional experience, time of intensive care experience, ICU level, and questions to define medical device-induced pressure injuries prepared by taking expert opinions.

Pressure Ulcer Knowledge Assessment Tool Scale: The Pressure Ulcer Knowledge Assessment Tool (PUKAT) (2010) developed by Beeckman et al.[17] is one of the most widely used knowledge assessment tools worldwide. With updated guidelines and recommendations, an updated version of the PUKAT was needed and Manderlier et al.[18] created the PUKAT-2.0. The PUKAT-2.0 is one of the few instruments that contains up-to-date information about pressure injuries with proven psychometric properties. Erbay Dalli et al. (2022) performed the Turkish validity and reliability of this version and the reliability coefficient for the whole tool was found to be high (0.83) in the analyses performed with the test-retest method. The reliability coefficient for the sub-scales was between 0.70 and 0.92, and the Kuder Richardson-20 (KR-20) and Cronbach's alpha value for internal consistency analysis were reported as 0.71. The scale consists of 6 sub-scales and 25 questions; Etiology (6 questions), Classification and Observation (4 questions), Risk Assessment (2 questions), Nutrition (3 questions), Prevention of Pressure Ulcers (8 questions) and Special Patient Groups (2 questions). The scale score is calculated based on the number of correct answers to the scale questions. For example, if the individual answers 20 questions correctly and 5 questions incorrectly, his/her score will be 20. The maximum score is 25 and the higher the score, the higher the level of knowledge[14]. In addition, the Cronbach's alpha value of the scale for this study was found to be 0.86.

Ethical Approval: Ethics committee approval was obtained from Marmara University, Faculty of Health Sciences, Non-Interventional Clinical Studies Ethics Committee with

the date and number 29.12.2022/137. Scale usage permissions were obtained from Erbay Dalli for the Pressure Ulcer Knowledge Level Assessment Tool (PUKAT 2.0) and permission was obtained from the Turkish Intensive Care Nurses Association for data collection. After Ethics Committee permission was obtained, the participants were informed about the research and the "Informed Consent Form" was obtained online.

Data Evaluation: The SPSS (Statistical Package for the Social Sciences) program was used for statistical evaluation of the data. Descriptive statistics such as percentage, frequency, mean and standard deviation and the significance test of the difference between categorical variables were used in the evaluation of the data. All results were evaluated at 95% confidence interval and $p<0.05$ significance level.

Limitations of the Study: The main limitations of the study were the difficulty in reaching nurses and the reluctance of nurses to participate in the study due to the difficulty of answering questions online. Therefore, the results cannot be generalized due to the limited number of nurses reached.

Results

Of the surgical intensive care nurses, 50.72% were between the ages of 26-33 (n=115), 62.1% were women (n=141), 67.4% were university graduates (n=153), 49.8 % of them had 1-5 years of nursing experience (n=113), 59.5% worked in tertiary intensive care (n=135), 66.1% worked in intensive care for 1-5 years, 93.8% had pressure injury training (n=213), 38.3% received this training at university (n=87), 51.5% had medical device-induced pressure injury training (n= 117) and 17.6% of them received this training during in-service training (n=40).

According to Table 1, it was determined that 43.6% of the participants (n = 99) answered the sacral/coccyx region as the most common region for pressure injuries caused by medical devices.

Table 1. Distribution of participants' responses related to the most common sites of pressure ulcers caused by medical devices (n=227)

Zone	**Most frequent (1)**	**(2)**	**(3)**	**(4)**	**Least frequent (5)**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Sacral/Coxix Zone	**99 (43,6)**	17 (7,5)	27 (11,9)	14 (6,2)	**70 (30,8)**
Heels	74 (32,6)	45 (19,8)	27 (11,9)	19 (8,4)	62 (27,3)

Ear-Head-Neck-Face	60 (26,4)	60 (26,4)	36 (15,9)	19 (8,4)	52 (22,9)
Elbows	74 (32,6)	45 (19,8)	41 (18,1)	**39 (17,2)**	28 (12,3)
Forearm	19 (8,4)	**88 (38,8)**	**54 (23,8)**	17 (7,5)	49 (21,6)

According to Table 2, it was determined that 98.7% of the participants correctly selected the right size medical device compatible with the individual (n=224), while 84.1% had the wrong information that medical device-induced pressure injuries occur only in immobilized patients (n=191).

Table 2. Participants' responses to the information questions (N=227)

Information questions and answers to be marked	**Correct n (%)**	**False n (%)**
Pressure injuries from medical devices only occur in the elderly because of their sensitive skin. (False)	8 (3,5)	219 (96,5)
Medical device-induced pressure injuries are local injuries caused by prolonged pressure of medical devices on the patient's skin. (Correct)	220 (96,9)	7 (3,1)
Medical device-induced pressure injuries are injuries caused by patient unconsciousness. (False)	117 (51,5)	110 (48,5)
Medical device-induced pressure injuries are caused by inadequate nursing care. (Correct)	193 (85)	34 (15)
Medical device-induced pressure injuries occur due to improper placement of devices. (Correct)	214 (94,3)	13 (5,7)
Medical device-induced pressure injuries are more common in young people than in the elderly. (False)	72 (31,7)	155 (68,3)
Mechanical ventilation does not cause pressure injuries. (False)	70 (30,8)	157 (69,2)
Pressure injuries caused by medical devices are the responsibility of the nurse. (Correct)	214 (94,3)	13 (5,7)
Medical device-induced pressure injuries occur only in immobilized patients. (False)	36 (15,9)	**191 (84,1)**

Every medical device that comes into contact with the patient is a risk for pressure injuries. (Correct)	223 (98,2)	4 (1,8)
The correct size medical device compatible with the individual is selected. (Correct)	**224 (98,7)**	3 (1,3)
Mobile devices should be removed or moved at least once a week to evaluate the skin. (False)	131 (57,7)	96 (42,3)
Mobile devices should be removed or moved at least once a week to evaluate the skin. (False)	131 (57,7)	96 (42,3)
Avoid placing the device in the area where there is a pressure injury or in risky areas (bone protruding areas with little adipose tissue, etc.). (Correct)	217 (95,6)	10 (4,4)
Devices should not be placed directly under the bedridden or immobile patient. (Correct)	209 (92,1)	18 (7,9)
The placement of medical devices around the patient should be positioned away from the application area. (False)	160 (70,5)	67 (29,5)

It was determined that 92.1% (n=209) of the participants correctly answered "positioning the patient every 2 hours" to the question "What is not the cause of MDIPI?" and thought that it would not cause medical device-induced pressure injury. Similarly, 98.7% (n=224) responded correctly to the medical devices that may cause MDIPI and the potential wound sites that these devices may cause.

According to Table 3, it was observed that 18.1% (n=41) of the participants thought that the most risky medical devices/materials to cause pressure injuries were non-invasive ventilation masks and 41.9% (n=95) percutaneous endoscopic gastrostomy (PEG) was the least risky.

Table 3. Distribution of participants' opinions regarding the risk of pressure injuries from medical devices/materials

Device/Materials	**Most risky (1)**	**(2)**	**(3)**	**(4)**	**Least risky (5)**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Blood pressure cuff	28 (12,3)	28 (12,3)	50 (22,0)	80 (35,2)	41 (18,1)
ECG electrodes and cables	13 (5,7)	34 (15,0)	51 (22,5)	**83 (36,6)**	46 (20,3)
Non-Invasive Ventilation masks	**41 (18,1)**	21 (9,3)	46 (20,3)	66 (29,1)	53 (23,3)

Compression stockings	14 (6,2)	**36 (15,9)**	42 (18,5)	56 (24,7)	79 (34,8)
Percutaneous Endoscopic Gastrostomy (PEG)	11 (4,8)	20 (8,8)	**63 (27,8)**	38 (16,7)	**95 (41,9)**

Table 4 shows the mean scores of the sub-scales and the total of the "Pressure Ulcer Knowledge Level Assessment Tool".

Table 4. Subscales and total mean scores of the pressure ulcer knowledge assessment tool

Subscales	**Mean**	**Standard Deviation**
Etiology	3,35	1,36
Classification and Observation	2,12	1,17
Risk Assessment	1,30	0,70
Nutrition	1,91	0,81
Prevention of Pressure Ulcers	4,74	2,31
Special Patient Groups	1,45	0,67
Total score	**14.8722**	**5.60392**

Table 5. Comparison of sociodemographic data and pressure ulcer knowledge level tool subscales

Pressure Ulcer Knowledge Level Assessment Tool Subscales													
Variant	**n**	**Etiology**		**Classification and Observation**		**Risk Assessment**		**Nutrition**		**Prevention of Pressure Ulcers**		**Special Patient Groups**	
		Test statistic	Binary analysis Bonferonni	Test statistic	Binary analysis Bonferonni	Test statistic	Binary analysis Bonferonni	Test statistic	Binary analysis Bonferonni	Test statistic	Binary analysis Bonferonni	Test statistic	Binary analysis Bonferonni
Age		H=26,238 **p=0,000**	a<d,e; b<d,e; c<e	H=49,418 **p=0,000**	a<d; a<e; b<d; b<e; c<d,e;	H=34,639 **p=0,000**	b<d,e	H=43,039 **p=0,000**	a<b; b<e; c<e	H=39,066 **p=0,000**	b<c,e; c<e	H=10,114 **p=0,039**	
18-25[a]	40												
26-33[b]	115												
34-41[c]	29												
42-49[d]	29												
50 and above[e]	14												
Gender													

Female	141	U=1,665 p=0,096		U=2,294 **p=0,022**		U=-0,612 p=0,541		U=0,579 **p=0,562**		U=1,094 p=0,274		U=1,094 **p=0,274**	
Male	86												
Education status		H=37,259 **p=0,000**	c>a,b,d	H=30,761 **p=0,000**	c>b	H=17,888 **p=0,000**	c>b,a	H=41,259 **p=0,000**	c>b,a	H=29,140 **p=0,000**	c>b,a	H=29,140 **p=0,000**	c>b,a
High School[a]	5												
University [b]	153												
Master's degree[c]	62												
Doctorate[d]	7												
Years of working as a nurse		H=30,054 **p=0,000**	d>a,b,c	H=63,772 **p=0,000**	d>a,b,c	H=40,852 **p=0,000**	d>a,b,c	H=53,191 **p=0,000**	d>a,b,c b>a	H=45,129 **p=0,000**	d>a,b,c	H=10,368 **p=0,016**	b>a
1-5 years[a]	113												
6-10 years[b]	52												
11-15 years[c]	22												
16 years and above[d]	40												
Working time in ICUs		H=33,323 **p=0,000**	d>a,b,c	H=61,693 **p=0,000**	d>a,b,c	H=37,363 **p=0,000**	d>a,b	H=49,308 **p=0,000**	d>a,b,c	H=44,699 **p=0,000**	d>a,b,c	H=17,506 **p=0,001**	d>a, b
1-5 years[a]	150												
6-10 years[b]	34												
11-15 years[c]	13												
16 years and above[d]	30												
What level of intensive care do you work in?		H=1,884 p=0,390		H=8,110 **p=0,017**	c > a	H=3,000 p=0,223		H=4,930 p=0,085		H=0,264 p=0,876		H=13,334 **p=0,001**	a >c
1. level[a]	43												
2. level[b]	49												
3. level[c]	135												
Have you received pressure ulcer training?						U=-1,716 p=0,086		U=-0,517 p=0,605		U=-2,957 **p=0,003**		U=-0,972 p=0,331	
Yes	213	U=-2,539 **p=0,011**		U=-3,354 **p=0,001**									
No	14												
Have you received training on medical device-induced pressure ulcers?													
Yes	117	U=0,147 p=0,883		U=-3,776 **p=0,000**		U=-1,590 p=0,112		U=-0,346 p=0,729		U=-0,640 p=0,522		U=-0,061 p=0,951	
No	110												

H= Kruskal Wallis Test; U=Mann Whitney U Test

Discussion

Despite innovations and developments in healthcare, pressure injuries caused by medical devices remain a major concern for healthcare professionals and healthcare institutions[10]. Therefore, nurses should have adequate knowledge and equipment about pressure injury[19,20]. Some studies have shown that the incidence and prevalence of pressure injuries have decreased over the last decade as a result of high quality, effective interventions[15,21]. Dalvand et al. (2018)[8], Qaddumi and Khawaldeh (2014)[22], Gül et al. (2017)[23] found that nurses had low knowledge scores on etiology, staging, observation and classification, risk assessment, pressure injury prevention, nutrition and special patient sub-scale. Contrary to these studies, other studies reported that nurses' knowledge scores were adequate in terms of their knowledge attitudes towards pressure injuries[24,25].This study found a significant difference between age, educational status, length of service as a nurse, length of service in the ICU, whether they had received training in pressure injuries or not, and the aetiology subscale of nurses' knowledge, attitude and self-efficacy levels, whereas no significant difference was found with gender. Unlike these findings, Başayar and Yazıcı (2022)[24] found a significant difference between gender and nurses' knowledge attitude level. When the literature is reviewed, the findings on the level of nurses' education and the level of pressure injury prevention knowledge and attitudes are mostly contradictory. In the study conducted by Nuru, Zewdu, Amsalu, and Mehretie (2015)[25], it was determined that the level of pressure injury prevention knowledge increased with increasing education level, while Yılmazer et al. (2019)[26] found no significant difference in terms of knowledge level between education levels. Although this study is a study with participation from across Turkey, it is limited to the population due to the small population. All types of pressure injuries are preventable health problems and prevention of pressure injury is the most effective treatment method. Nurses should be updated on the literature and know how to prevent pressure related injuries[27]. The literature emphasises that nurses' knowledge of pressure injuries is inadequate and that this leads to pressure injuries[2-4,14]. Therefore, caregiver nurses should have sufficient knowledge and equipment about pressure injury. This study found that the level of knowledge about the prevention of medical device pressure injuries increased with the level of education. The introduction of medical devices used in patient treatment should be made to nurses/nursing students through the relevant persons and possible accidents and errors arising from misuse should be minimized[12].

Emphasised in the literature that nurses' knowledge of pressure injury is inadequate and this leads to pressure injury. In line with many other studies, the most common site of pressure injuries caused by medical devices in our study was the sacrum[12,15,21]. In this regard, attention can be paid to patient positioning, prolonged stay in the supine position can be prevented, and support surfaces (pads, foam, etc.) suitable for that area can be used[27]. Most of our participants know in which part of the body the devices used can cause pressure injuries. In this regard, it can be said that there is a need to create awareness that the skin and devices should be checked regularly. Based on the findings, further studies are needed to help develop evidence-based policies and procedures to prevent medical device-induced pressure.

Conclusions

To increase nurses' knowledge of MDIPI, it is recommended that hospitals provide regular educational programs, especially for intensive care nurses, who are both the most device-intensive and the most frequently exposed to pressure injury problems in hospitals. In addition, hospitals can implement evidence-based prevention strategies such as care bundles that include interventions such as skin assessment, device selection, device/instrument repositioning, and education.

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