

## Assessment of The Risk of Pressure Injury Development in Adult Patients Preoperatively and in the Operating Room

### Yetişkin Hastalarda Ameliyat Öncesi ve Ameliyathanede Basınç Yaralanması Gelişme Riskinin Değerlendirilmesi

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#### ÖZET

**Amaç:** Basınç yaralanmalarının bireysel ve kurumsal açıdan farklı olumsuz etkileri olup bu yaralanmalar hastanede kalış süresinin, sağlık bakım harcamalarının ve mortalite oranlarının artmasına neden olabilmektedir. Bu çalışma, bir üniversite hastanesinde ameliyat olan yetişkin hastaların klinikten ayrılmadan önce ve ameliyathanede basınç yarısı riskinin değerlendirilmesi amacıyla yapılmıştır.

**Yöntem:** Bu çalışma, metodolojik bir çalışmadır. Araştırmanın örneklemini, Ankara'da bulunan bir üniversite hastanesinde yatan ve 01 Mart 2021- 01 Şubat 2022 tarihleri arasında ameliyat olan 589 hasta oluşturmuştur. Veriler, Sosyodemografik ve Klinik Özellikler Formu, 3S Ameliyathane Basınç Yarısı Risk Tanılama Ölçeği ve Waterlow Basınç Yarısı Risk Tanılama Ölçeği ile toplanmıştır. Veriler SPSS 24 programı ile analiz edilmiştir.

**Bulgular:** Bu çalışmada; hastaların %61,5'u kadın, %49,8'inin 41-64 yaş grubunda olduğu, %84,9'unun kronik hastalığı bulunurken, hastaların tamamı genel anestezi ile ameliyat olmuştur. Hastaların hiçbirinde basınç yarısı mevcut değildir. Hastaların 3S Ameliyathane Basınç yarısı ölçeğine göre %99,5'u düşük risk; Waterlow Basınç yarısı ölçeğine göre ise %71,1'i risk yok ve %19,5'u düşük risk olarak değerlendirilmiştir.

**Sonuç:** Ameliyat olan 65 yaş ve üstü hastaların ve kronik hastalığı olma durumunun basınç yarısı gelişme riskini arttırdığı görülmektedir. Ameliyat olan ortopedi hastalarının, yatan hastalarda ise KVC hastalarının bası yarısı gelişme riskinin diğer bölüm hastalarına göre daha fazla olduğu görülmüştür.

**Anahtar Kelimeler:** Hemşire, hemşirelik, basınç yarısı, basınç yarısı risk değerlendirilmesi

#### ABSTRACT

**Aim:** Pressure injuries have various adverse effects on both individual and institutional levels, leading to increased hospital stays, healthcare costs, and mortality rates. This study aims to evaluate the risk of pressure injury development in adult patients undergoing surgery at a university hospital, both preoperatively and intraoperatively.

**Method:** This methodological study included 589 patients who underwent surgery between March 1, 2021, and February 1, 2022, at a university hospital in Ankara. Data were collected using the Sociodemographic and Clinical Characteristics Form, the 3S Intraoperative Pressure Ulcer Risk Assessment Scale and the Waterlow Pressure Ulcer Risk Assessment Scale. Data were analyzed using SPSS 24 software.

**Findings:** In this study, 61.5% of the patients were female, 49.8% were aged between 41 and 64 years, 84.9% had a chronic disease, and all of the patients underwent surgery under general anaesthesia. None of the patients suffered from pressure injuries. According to the 3S Intraoperative Pressure Ulcer Risk Assessment Scale, 99.5% of the patients were at low risk, and according to the Waterlow Pressure Ulcer Risk Assessment Scale, 71.1% were considered as no risk and 19.5% as low risk.

**Conclusion:** It was observed that the risk of developing pressure injuries increased in patients aged 65 and over who underwent surgery and had a chronic disease. It was observed that the risk of developing pressure sores was higher in orthopaedic patients who had surgery and in CVS patients who were hospitalized than patients from other departments.

**Keywords:** Nurse, nursing, pressure injury, pressure injury risk assessment

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## INTRODUCTION

The concept of patient safety, which assures quality in health services and ensures that patients get a safe healthcare for patients, is defined as the pre-determination of all medical and physical risks for patients and their relatives who come to a health institution for treatment, eliminating these risks before they affect the patient and taking precautions (Slawomirski et al., 2017; Balçık Akman, 2010). One of the patient safety objectives, pressure injury, remains a significant issue for patients, healthcare professionals, and the healthcare system (Gencer & Özkan, 2015). Although various terms such as decubitus injury, bedsore, and pressure sore are used in the literature the most prevalent term is pressure injury (Edsberg et al., 2016; Lyder et al., 2012). Pressure injuries, historically known as decubitus injury or bedsore, are currently referred to as "pressure injuries" according to the guidelines set by the National Pressure Injury Advisory Panel (NPIAP) in 2019. NPIAP defines a pressure injury as *"localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device, as a result of intense and/or prolonged pressure or pressure in combination with shear"* (Mervis et al., 2019; NPIAP 2019). The International NPUAP/EPUAP Pressure Ulcer Classification System, updated in 2009 and 2016, categorizes pressure sores into four stages. Stage 1: Skin integrity is intact. Does not fade by pressing in a certain area erythema is present. Stage 2: There is tissue loss in the dermis. Fat tissue and deeper tissues there is no involvement. The wound is red or pink, with intact or ruptured bullae. Stage 3: There is complete loss of skin with adipose tissue. Fascia, muscle tissues, tendon and bone are not affected. Stage 4: There is complete tissue loss. Muscle tissue, tendon, cartilage or there is tissue loss where bones are affected. It is called 'unstaged compression injuries' in which tissue damage is not visible to the naked eye, but skin integrity is completely impaired and tissue loss occurs. When the scar tissue is removed, the

pressure injury can usually be graded as stage 3 or 4. In a pressure injury with 'Suspected Deep Tissue Damage', the skin is redder than there is a dyscoloration or epidermal separation that may vary to darker colors. Mucosal pressure injuries, added to the staging system in recent sources, but staging cannot be done with the above system because the color change in the mucosa cannot be evaluated clearly and bone tissue is not affected. This nomenclature includes pressure injuries associated with medical devices such as endotracheal tubes and nasogastric catheters (EPUAP, NPUAP 2009; EPUAP 2016). A pressure injury is a medical complication caused by prolonged pressure that causes ischemic changes in tissues (Gencer & Özkan, 2015). It is a localized damage to the skin and/or subcutaneous tissue, usually developing over bony prominences (Edsberg et al., 2016). When examining hospital-acquired pressure injuries from the perspectives of the patient and the institution, the length of hospital stay increases, leading to higher healthcare expenditures and mortality rates, depending on the duration of treatment (Gencer & Özkan, 2015; Yıldırım & Kocaman, 2017). The development of pressure injuries is not caused by a single factor; The basis of the causative factors is; "pressure, rubbing, and lacerating" (Coleman et al., 2013; Cooper, 2013). The key factor contributing to the development of pressure injuries is prolonged exposure to pressure. While pressure is the most significant factor in the formation of a pressure sore, other contributing factors include age, prolonged immobility, chronic diseases, malnutrition, paralysis, low albumin levels, hemoglobin levels below normal, circulatory disorders, necrosis, hypotension, immobility, decreased sensory/mental perception, urinary/fecal incontinence, severe nutritional deficiencies, incontinence, sensory impairment, infection, wound development, and chronic diseases (Esen et al., 2016; Jaul & Menzel, 2014; Ögülmüş et al., 2018). Furthermore, both extrinsic factors (the patient's immobility

during surgery, inability to change position, the at-risk areas such as the coccygeal/sacral region, hips, heels, etc., the duration of the procedure, the type of anesthesia used, the medical devices used, etc.) and intrinsic factors (age, smoking, diseases, etc.) contribute to pressure-related injury in patients undergoing surgery (AORN, 2016; Gül, 2014; Karadağ et al., 2016; Karadağ & Karabağ, 2013; Lumbeley et al., 2014; Öğülmüş et al., 2018). Although the prevention of pressure injuries is critical for both patients and institutions, it is mostly achievable if the necessary precautions are taken. Therefore, all hospitalized and surgical patients should be assessed for the risk of pressure sores, risk factors should be identified, and necessary precautions should be planned (Aygör et al., 2014; Spruce, 2017; O'Brien et al., 2014). Risk assessment is the most important and first step in preventing the development of pressure injuries. Selecting the proper assessment tool for the right patient is critical to accurately identifying risk. To assess the risk of pressure injury development in hospitalized patients, several assessment tools developed for different groups are available in the literature that assesses the risk of developing multiple pressure injuries (Kottner & Balzer, 2010). The development of pressure injuries may be prevented by assuring the planning, follow-up, and continuity of individual care by selecting and employing accurate and reliable risk assessment tools appropriate for the patient group (Ersoy Ortaç et al., 2013).

### Objective

This study was designed to assess the risk of developing pressure injuries in adult patients who underwent surgery at a university hospital, both before leaving the clinic and in the operating room.

### Research Questions

- What is the risk level of pressure injuries before patients leave the clinic and in the operating room?
- Do socio-demographic and clinical characteristics have an impact on the risk of developing pressure injuries?

- How is the 3S Pressure Ulcer Risk Assessment Scale correlated with the Waterlow Pressure Ulcer Risk Assessment Scale?

## METHODS

### Type of Research

The research was designed to be correlational and descriptive.

### Population and Sample

The study was single-centred and consisted of 589 patients who were hospitalized in a university hospital in Ankara and underwent surgery between March 1, 2021, and February 1, 2022. Patients in the specified units (Cardiology, Cardiovascular Surgery, General Surgery, Gynecology, Orthopedics, Plastic Surgery, Thoracic Surgery, Neurosurgery, Urology et al.) were considered the study population during the research period. The entire population was included.

### Data Collection Tools

**Sociodemographic And Clinical Characteristics Information Form:** This form consists of seven questions designed by the researchers to gather socio-demographic and clinical information about the patients, including age, gender, chronic disease, hospitalization department, type of anesthesia used, surgery name, and diagnosis.

**3S Intraoperative Pressure Ulcer Risk Assessment Scale:** The “3S Intraoperative Pressure Ulcer Risk Assessment Scale” was developed by Gao et al., (2015) to assess the risk factors for pressure injury in patients who underwent surgery. Its Turkish validity and reliability study was conducted by Soyer & Özbayır (2018). The scale consists of nine criteria (skin condition across the body, state of preoperative activity, height/weight ratio, skin stress condition, the quantity of blood lost during the surgery, duration of the surgery, stress during the surgery, body temperature throughout the surgery, and position of the surgery), and the items on the scale range from one to four points on a four-point Likert scale. The overall score is calculated by summing the scores from each item, with a minimum of 9 and a maximum of 36 points. The risk of

pressure injuries increases as the total score increases; scores above 23 points are regarded as high risk, while scores  $\leq 23$  points are considered low risk (Soyer & Özbayır, 2018). The content validity index of the original scale is 0.92, and the Cronbach  $\alpha$  value is 0.71 (Gao et al., 2015). In the study conducted by Soyer et al., the Cronbach  $\alpha$  reliability coefficient for the 3S Operating Room Pressure Wound Risk Diagnosis Scale was found to be 0.68 (Soyer & Özbayır, 2018). In this study, the Cronbach  $\alpha$  was found to be 0.63

**Waterlow Pressure Ulcer Risk Assessment Scale Scale:** The scale was developed by Judy Waterlow for use internal medicine and surgical clinics and was adapted to Turkish by Avşar and Karadağ. It consists of two parts: risk assessment and prevention (Avşar & Karadağ., 2016; Waterlow, 1985). The part of prevention in the scale includes information on the classification, prevention, and nursing care of pressure injuries. The scale consists of ten items (body mass index, skin type in risky areas, gender-age, malnutrition screening tool, mobility, tissue malnutrition, neurological disorder, major surgery or trauma). Each item is scored between 0 and 8. According to the total score, 10-14 points indicate a risk, 15-19 points indicate high risk, and 20 points or above indicate very high risk (Waterlow, 2005). In the study by Avşar and Karadağ, the intraclass correlation coefficient was calculated to be 0.95, representing the reliability coefficient according to the risk level of the patients. In this study, the Cronbach alpha value was found to be 0.74

#### **Collection of Data**

Data were collected by researchers by reviewing patient files. During the data collection process, the Waterlow Scale was routinely completed by nurses for each hospitalized patient, involving procedures such as skin assessment. However for patients who will undergo surgery, the scale was completed preoperatively and re-evaluated postoperatively once the patient returned to their bed/room. Considering the risk of pressure injuries development during the

operating room process; the quality and education unit was consulted. Patients were asked to fill out the routine Waterlow form before entering the operating room and the 3S Pressure injury assessment form in the operating room. In this way, it was aimed to evaluate whether there was a difference in the operating room and clinic/intensive care process, and if there was a difference, to determine and reduce the risk in the operating room. The hospital quality unit and nurses provided the necessary control in the process. The process was implemented within the scope of corrective improvement activities conducted by the quality and nursing services unit.

#### **Ethical Permission**

In addition, permission was obtained from the Clinical Research Ethics Committee of TOBB ETU Faculty of Medicine (KAEEK-118/120) to conduct the study. The validity and reliability of the 3S Intraoperative Pressure Ulcer Risk Assessment Scale used in the clinical field was obtained by e-mail from Özlem Soyer Er in 2018. Each hospitalized patient is mandatorily evaluated for pressure sores in accordance with health quality standards. Corrective-preventive-improvement activities are implemented in pressure injury assessments. Beyond the routine pressure injury assessment for each patient, an additional assessment was conducted in the operating room to identify any differences in the operating room processes. Consent was obtained from patients upon hospitalization.

#### **Data Assessment**

The Statistical Package for the Social Sciences (SPSS) for Windows, version 24.0, was used to analyze the data. Descriptive statistics including number, percentage, mean, standard deviation, and minimum and maximum values were used to analyze the data. The Kolmogorov-Smirnov test was applied to assess the normality of the data distribution. To compare two independent groups, the Mann-Whitney U test and t-test were utilized. For comparisons involving three or more independent groups, the Kruskal-Wallis test and ANOVA were employed to analyze

differences between groups. The level of  $p < 0.05$  was accepted statistically significant.

## FINDINGS

When the distribution of demographic and clinical characteristics of the patients included in the sample was examined, it was observed that 61.5% of the patients were female, and 49.8% were between the ages of 41 and 64. The mean age of the participants was  $61.00 \pm 13.83$  (min 18, max 87). While 84.9% of the patients had a chronic disease, all of the patients were operated under general anaesthesia. None of the patients suffered pressure injuries. When the mean scores of the

patients on the pressure injury scales were examined, the mean score on the “3S Intraoperative Pressure Ulcer Risk Assessment Scale” was  $15.71 \pm 2.37$  (min 10, max 26) and the mean score on the “Waterlow Pressure Ulcer Risk Assessment Scale” was  $7.46 \pm 4.76$  (min 2, max 26). According to the “3S Intraoperative Pressure Ulcer Risk Assessment Scale”, 99.5% of the patients were at low risk, and according to the “Waterlow Pressure Ulcer Risk Assessment Scale”, 71.1% were considered as no risk, and 19.5% as low risk. 81% of the patients were underwent surgery in the Department of Cardiovascular Surgery (Table 1).

**Table 1. Socio-demographic and Clinical Characteristics of the Patients**

| Descriptive Characteristics                            | N                                  | %    |
|--|------------------------------------|------|
| Age (X $\pm$ SS)(min-max)                              | $61.00 \pm 13.83$ (min 18, max 87) |      |
| Age  |                                    |      |
| < 40 years and below                                   | 59                                 | 10.0 |
| 41-64 years  | 293                                | 49.8 |
| > 65 years and above                                   | 237                                | 40.2 |
| Total  | 589                                | 100  |
| Gender   |                                    |      |
| Male   | 227                                | 38.5 |
| Female   | 362                                | 61.5 |
| Total  | 589                                | 100  |
| Chronic Disease  |                                    |      |
| Yes  | 500                                | 84.9 |
| No   | 89                                 | 15.1 |
| Total  | 589                                | 100  |
| 3S Scale Score (X $\pm$ SS)(min-max)                   | $15.71 \pm 2.37$ (min 10, max 26)  |      |
| Waterlow Scale Score (X $\pm$ SS)(min-max)             | $7.46 \pm 4.76$ (min 2, max 26)    |      |
| 3S Intraoperative Pressure Ulcer Risk Assessment Scale |                                    |      |
| Low Risk   | 586                                | 99.5 |
| High Risk  | 3                                  | 0.5  |
| Total  | 589                                | 100  |
| Waterlow Pressure Ulcer Risk Assessment Scale          |                                    |      |
| No Risk  | 419                                | 71.1 |
| Low Risk   | 115                                | 19.5 |
| High Risk  | 38                                 | 6.5  |
| Very High Risk   | 17                                 | 2.9  |
| Total  | 589                                | 100  |
| Anaesthesia Type - General                             | 589                                | 100  |
| Department   |                                    |      |
| Cardiology   | 24                                 | 4.1  |
| Cardiovascular Surgery                                 | 477                                | 81.0 |
| General Surgery  | 22                                 | 3.7  |
| Gynaecology  | 8                                  | 1.4  |
| Orthopaedics   | 6                                  | 1.0  |
| Plastic Surgery  | 16                                 | 2.7  |
| Thoracic Surgery                                       | 2                                  | 0.3  |
| Brain Surgery  | 17                                 | 2.9  |
| Otolaryngology   | 10                                 | 1.7  |
| Urology  | 7                                  | 1.2  |
| Total  | 589                                | 100  |

Table 2 shows the correlation between the two pressure injury scales in terms of the patients' pressure injury risk assessment scores. There

was a strong correlation between these two scales, and the correlation between them was statistically significant ( $r = .548$   $p = 0.025$ ) ( $p < 0.05$ ).

**Table 2. The Correlation Between Two Pain Scales by Assessment Days (n=589)**

| Scales   |                       | WATERLOW | 3S     |
|----------|-----------------------|----------|--------|
| WATERLOW | Pearson's correlation | 1        | 0.548* |
|          | Sig. (2-tailed)       |          | 0.025  |
|          | N                     |          | 589    |
| 3S       | Pearson's correlation | 0.548*   |        |
|          | Sig. (2-tailed)       | 0.025    | 1      |
|          | N                     | 589      |        |

Pearson's correlation t-test

When examining the difference between the age variable and the mean scores of pressure injury risk on the two scales, it was found that the risk of developing pressure injuries was higher in the patient group aged 65 and older compared to other age groups, and this difference was statistically significant (3S  $p = 0.000$ , Waterlow  $p = 0.000$ ) ( $p < 0.05$ ) (Table

3). Additionally, the difference between the presence of chronic disease and the mean scores of pressure injury risk on the two scales indicated that patients with chronic diseases had a higher risk of developing pressure injuries, and this was statistically significant (3S  $p = 0.000$ , Waterlow  $p = 0.000$ ) ( $p < 0.05$ ) (Table 3).

**Table 3. Comparison of Mean Scores of the Waterlow and 3S Pressure Ulcer Scales Based on Descriptive Characteristics of the Patients**

| Variable               | n   | 3S PRESSURE ULCER SCORES        |      | WATERLOW PRESSURE ULCER SCORES  |      |
|------------------------|-----|---------------------------------|------|---------------------------------|------|
|                        |     | X                               | SD   | X                               | SD   |
| Gender                 |     |                                 |      |                                 |      |
| Male                   | 362 | 15.57                           | 2.20 | 8.36                            | 5.16 |
| Female                 | 227 | 15.94                           | 2.62 | 6.89                            | 4.41 |
|                        |     | t= 1.742 p= 0.082               |      | t= 3.558 p= 0.000               |      |
| Age                    |     |                                 |      |                                 |      |
| 40 years and below     | 59  | 14.85                           | 2.44 | 3.80                            | 2.61 |
| 41-64 years            | 293 | 15.43                           | 2.33 | 6.22                            | 3.98 |
| 65 years and above     | 237 | 16.30                           | 2.28 | 9.92                            | 4.89 |
| Total                  | 589 | 15.72                           | 2.37 | 7.46                            | 4.76 |
|                        |     | X <sup>2</sup> = 13.858 p=0.000 |      | X <sup>2</sup> = 73.483 p=0.000 |      |
| Chronic Disease        |     |                                 |      |                                 |      |
| Yes                    | 500 | 15.95                           | 2.21 | 7.94                            | 4.84 |
| No                     | 89  | 14.42                           | 2.82 | 4.76                            | 3.17 |
| Total                  | 589 | t= 4.849 p=0.000                |      | t= 6.416 p= 0.000               |      |
| Department             |     |                                 |      |                                 |      |
| Cardiology             | 24  | 15.54                           | 2.30 | 7.21                            | 4.69 |
| Cardiovascular Surgery | 477 | 15.98                           | 2.21 | 7.99                            | 4.84 |
| General Surgery        | 22  | 15.36                           | 3.17 | 5.64                            | 4.32 |
| Gynaecology            | 8   | 13.13                           | 2.58 | 4.63                            | 2.72 |
| Orthopaedics           | 6   | 16.33                           | 3.61 | 6.17                            | 1.72 |
| PLASTIC                | 16  | 13.88                           | 2.27 | 3.25                            | 0.44 |
| Thoracic Surgery       | 2   | 15.00                           | 2.82 | 3.50                            | 0.70 |
| Neurosurgery           | 17  | 14.47                           | 2.32 | 5.35                            | 3.51 |
| Otolaryngology         | 10  | 12.70                           | 1.82 | 2.50                            | 0.70 |
| Urology                | 7   | 13.71                           | 2.49 | 5.29                            | 2.92 |
| Total                  | 589 | 15.71                           | 2.37 | 7.46                            | 4.76 |
|                        |     | X <sup>2</sup> = 6.221 p= 0.000 |      | X <sup>2</sup> = 4.931 p= 0.000 |      |

X<sup>2</sup>=Kruskal Wallis variance analysis, t = Independent samples t-test

When the difference between patient genders and the mean score of the two pressure injury risk assessment scales was examined, a statistically significant difference was found only between gender and the scores on the Waterlow pressure injury risk assessment scale (Waterlow  $p=0.000$ ) ( $p<0.05$ ). According to the Waterlow Pressure injury Risk Assessment Scale, male patients were at a higher risk group in terms of developing a pressure injury; indicating they were more likely to develop a pressure injury (Table 3).

When the difference between the departments where patients were hospitalized and the mean score of the pressure injury development in two scales was examined, the difference between the departments and the risk of pressure injury development on both scales were statistically significant (3S  $p=0.000$ , Waterlow  $p=0.000$ ) ( $p<0.05$ ). The risk of developing pressure injury was higher in orthopaedic patients ( $p=0.000$ ) on the 3S Pressure Injury Risk Scale and in CVS patients on the Waterlow Pressure Injury Scale ( $p=0.000$ ). (Table 3).

## DISCUSSION

Coleman et al. (2013) found that multiple factors contribute to the risk of pressure injuries, exhibiting a complex structure. Oxygen and nutrients carried to the tissue by blood flow are absorbed by the tissue, while waste products are removed through the circulatory system. Any obstruction to blood flow affects cell metabolism and function, reducing or eliminating the blood supply to the tissue due to sustained high pressure, and thus, impeding adequate blood flow. The frequency, duration, and intensity of pressure, along with the tissue's tolerance to pressure, are crucial in wound formation (Çavuşoğlu et al., 2020; Karadağ et al., 2016; Ögülmüş et al., 2018). The study concluded that male patients had higher Waterlow pressure injury scores compared to female patients, and this difference was statistically significant ( $p=0.000$ ). Conversely, age was not found to have an effect on operating room pressure

injuries ( $p>0.05$ ). The study also observed that the risk of developing pressure injuries was higher in the patient group aged 65 and older compared to other age groups on both scales, and this difference was statistically significant (3S  $p=0.000$ , Waterlow  $p=0.000$ ) ( $p<0.05$ ). Anemia is thought to both increase wound formation and slow down wound healing, particularly in elderly patients, due to its association with frailty (Landi et al., 2007).

In the study, when examining the difference between the presence of chronic disease and the mean scores of pressure injury risks on two different scales, it was observed that the risk of developing pressure injuries was higher in patients with chronic diseases on both scales, and this difference was statistically significant (3S  $p=0.000$ , Waterlow  $p=0.000$ ) ( $p<0.05$ ). In a study conducted by Usanma Koban et al. on 503 patients hospitalized in the Palliative Care Center of Haydarpaşa Numune Training and Research Hospital (EAH), it was found that the most at-risk group for wound formation in palliative care patients were those who had experienced a cerebrovascular accident. Similarly, a 2014 study by Carlsson et al., which included all deceased patients over the age of 17 ( $n=60.319$ ) enrolled in the Swedish Palliative Care Service, found that diseases such as cancer, dementia, and stroke increased the occurrence of pressure injuries.

In the study, when examining the difference between the departments where patients were hospitalized and the mean scores of pressure injury development on the two scales, the differences between departments and the risk of pressure injury development on both scales were found to be statistically significant ( $p<0.05$ ). The risk of developing pressure injuries was higher in orthopedic patients ( $p=0.000$ ) on the 3S Pressure Injury Risk Scale, and in cardiovascular surgery (CVS) patients on the Waterlow Pressure Injury Scale ( $p=0.000$ ). Numerous studies have established a statistically significant relationship between intensive care history and pressure sores, showing that the risk of wounds increases with longer stays in intensive care.

## Limitations

The results of this study are limited to the sample size and cannot be generalized. The participants were assessed solely during the preoperative and intraoperative periods. Another limitation of the study is that other factors that induce pressure injury during the intraoperative period due to time limits, as well as the inability to quickly observe the damage produced by pressure during the postoperative period were not evaluated.

## CONCLUSION

Given that the primary goal of preventing pressure injuries is to identify patients at risk, it is critical to utilize an appropriate risk assessment scale. Not only is the correct selection of the risk assessment tool effective in preventing the development of pressure injuries, but so is the correct usage of the appropriate risk assessment tool and addressing any deficiencies in the assessment. In this study, it was observed that the risk of developing pressure injuries increased in patients aged 65 and over who underwent surgery and had a chronic disease. According to the Waterlow Pressure Injury Risk Assessment Scale, it was concluded that male patients were in a higher risk group for developing a pressure injury. Furthermore, it was observed that the risk of developing pressure injuries was higher in orthopaedic patients who had surgery and in the CVS patients who were hospitalized than in patients from other departments. It is recommended that every hospitalized patient be assessed for

the risk of pressure injuries using an appropriate scale and that the nurses conducting the assessment be trained in this matter. Additionally, monitoring pressure injury development through studies on surgical patients and long-term patient follow-up is essential. Working with larger patient groups to identify the risk of pressure injuries among other surgical patients is also advised. Furthermore, it is recommended that the 3S Intraoperative Pressure Injury Risk Assessment Scale be expanded with studies focusing on the standard and protective measures to be taken.

## Conflict of Interest Statement

We have no conflicts of interest

## Funding Statement

We did not use any funding for the study.

## Author contributions

Conception: TM, YÖ

Design: TM, YÖ, MA

Data collection: TM, AY

Analysis and interpretation of data: TM, YÖ

Drafting the manuscript: TM, YÖ, MA, AY

Critical review: TM, YÖ

All authors (TM, YÖ, MA, AY) reviewed the results and approved the final version of the article.

## Ethics Committee

This study is approved by TOBB-ETU Clinical Research (KA EK-118/120. / 27.04.2022).

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