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Research Article / Araştırma Makalesi

Effects of Hemoglobin and Albumin Levels on the Development of Pressure Injury in Inpatients in Intensive Care

Yoğun Bakım Kliniklerinde Yatan Hastalarda Hemoglobin ve Albumin Değerlerinin Basınç Yarası Gelişine Etkisi

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Abstract: Pressure injury are accepted as an indicator of inadequate care all over the world. It also prolongs the length of hospital stay and increases the rates of mortality and morbidity. In our study, the effects of hemoglobin and albumen values on the development of pressure injury were investigated. Personal Information Form and EFGU Pressure Ulcer Risk Assessment Scale were used to collect the study data. The sample of the descriptive study consisted of 68 adults over the age of 18 who were hospitalized in intensive care clinics between November 2021 and March 2022. The mean age of the patients included in the study was 67.08±14.35 years. Of them, 42.6% were women, 17.6% were intubated, and 57.4% had the normal state of consciousness. The rate of pressure injury development in patients was 26.5%. In our study, it was determined that hemoglobin and albumin values in patients with pressure injury hospitalized in intensive care clinics were lower than those without pressure injury, and the difference was statistically significant.

Keywords: Pressure injury, Hemoglobin, Albumin.

Öz: Bası yaraları tüm dünyada bakımın yetersizliğinin bir göstergesi olarak kabul edilmektedir. Ayrıca hastanede yatış süresini uzatmakta ve mortalite ve morbitide oranlarını da arttırmaktadır. Çalışmamızda hemoglobin ve albümün değerlerini basınç yarası gelişimi üzerine olan etkisi incelenmiştir. Araştırma verilerinin toplanmasında Kişisel Bilgi Formu ve EFGU Basınç Ülseri Risk Değerlendirme Ölçeği kullanılmıştır. Tanımlayıcı tipte olan araştırmanın örneklemini Kasım 2021 – Mart 2022 tarihleri arasında yoğun bakım kliniklerinde yatan 18 yaş üzeri 68 yetişkin birey oluşturdu. Çalışma kapsamına alınan hastaların yaş ortalamalarının 67.08±14.35, %42.6'sının kadın, %17.6'sının entübe, %57.4'ünün normal bilinç düzeyine sahip olduğu belirlendi. Hastalarda bası yarası gelişme oranı %26.5'dir. Çalışmamızda yoğun bakım kliniklerinde yatan, bası yarası gelişen hastalarda hemoglobin ve albümin değerlerinin bası yarası gelişmeyen hastalara göre daha düşük olduğu ve farkın istatistiksel olarak anlamlı olduğu belirlenmiştir.

Anahtar Kelimeler: Bası yarası, Hemoglobin, Albumin.

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Introduction

Pressure injuries which are localized skin and / or subcutaneous tissue damage that occurs on bony prominences are usually caused by pressure alone, or by the combination of shearing and pressure (EPUAP/NPIAP/PPPIA: 2019). Pressure injuries, which are accepted as an indicator of quality of the health service provided in treatment institutions, increase mortality, morbidity rates and treatment costs (Bahar and Özgürbüz, 2022; Brito et al., 2013; Kottner and Peytavi, 2021).

According to the results compiled by the National Pressure Ulcer Advisory Panel (NPUAP) from 300 studies, the incidence of pressure injuries ranges between 0.4% and 38% in acute care areas and between 2.2% and 23.9% in long-term care areas (EPUAP 2016). In studies conducted in Europe, this rate varies between 8.3% and 25.1% (Gencer et al., 2018; Neziraj et al., 2021; Kalmann

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and Suserud, 2008). In studies conducted in our country, the rate varies between 14% and 54.8% (Çınar et al.,2018; Çelik 2016; İnan and Öztunç, 2012). The main risk factors stated to predispose to scar formation in the literature are restriction of mobility and activity. Along with this, factors that impair tissue oxygenation or perfusion, poor general health of the patient, decreased sensation, advanced age, nutritional deficiency and related hematological and biochemical changes also play a role in the formation of pressure injuries (Langemo et al., 2015; NPIAP/ EPUAP/ PPPIA:2014; Coleman et al., 2013; Tsaras et al., 2016; Stephen-Haynes 2012).In particular, factors such as restricted mobility, impaired tissue perfusion, dyspnea, edema, malnutrition, and decreased sensory perception due to analgesia also explain the formation of pressure injuries that are frequently encountered in patients staying in intensive care or palliative care units (Langemo et al., 2015; Stephen-Haynes 2012; Artico et al., 2018). Various methods such as body mass index, calculation of calories taken, measurement of albumin, prealbumin, hemoglobin, hematocrit, and scoring with malnutrition scales are used to determine the nutritional status of patients receiving intensive care (Langemo et al., 2015). Albumin is a frequently measured parameter since it is thought to indicate whether the amount of protein in the body is adequate, and to play a role in wound healing because it carries zinc, which plays a role in collagen formation (Taylor 2017). In recent studies, it has been demonstrated that albumin provides information not only about the nutritional status of the patient but also about the severity of the underlying disease and the prognosis of the patient (Dorner et al., 2009; Bouillanne et al., 2011; Sugino et al., 2014). In the literature, in several studies, blood parameters have been used to investigate the relationship between nutrition and pressure injuries While in several publications, hypoalbuminemia has been shown as a risk factor for scar formation (Efteli and Güneş 2013; Serra et al., 2014; Bly et al., 2016), Anthony et al. (2011) argue that albumin is a valuable parameter to be used in wound scoring. In addition to albumin, the hemoglobin value also gives an idea about the nutritional status; therefore, the relationship between the hemoglobin value and pressure injuries has been investigated. In several publications, the presence of anemia has been shown to increase the risk of injury formation in patients receiving intensive care or palliative care (Bly et al., 2016: Landi et al., 2007). Especially in older patients, anemia, due to its association with fragility, is thought to increase wound formation and to slow down wound healing (Landi et al., 2007). It is important to keep the albumin and hemoglobin values, which are nutritional parameters, at the desired level in order to prevent the development of pressure injury and to accelerate the healing in patients with pressure injury.

In our study, it was aimed to reveal the effect of albumin and hemoglobin levels on the development of pressure injuries in patients hospitalized in intensive care clinics.

Materials and Methods

Design and setting

This methodological study was carried out in the intensive care units of a public hospital between November 1, 2021 and March 1, 2022.

Sample

68 patients recently admitted to the units where the study was conducted were included in the study. The inclusion criteria were as follows: being over the age of 18 years, having no pressure injuries, being bedridden, and having been hospitalized for at least six days. The exclusion criteria were as follows: having a pressure injury on admission to the hospital, and taking inotropic and/or vasopressor drugs.

Instrument Data Collection Tools

Personal Information Form and EFGU Pressure Ulcer Risk Assessment Scale both of which were developed by the researcher were used to collect the study data.

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Personal Information Form: The form includes five questions on the participants' age, sex, albumin and hemoglobin levels, and pressure injury development.

EFGU Pressure Ulcer Risk Assessment Scale: The scale was developed by Efteli and Güneş in 2020 to determine the risk of pressure injury formation in patients receiving intensive care. The scale has seven items questioning variables such as age, diastolic blood pressure levels, skin condition in risky areas, feeling of discomfort and pain in areas under pressure, skin tolerance test results, incontinence, and small changes in the body position. Each scale item was scored ranging from 0 to 3. Age and diastolic blood pressure were scored as 0-1 points. The condition of the skin in the risky areas, the feeling of discomfort and pain in the areas under pressure and the skin tolerance test results were scored as 0-2 points. Incontinence and small changes in the body position were scored as 0-3 points. The minimum and maximum possible scores to be obtained from the scale are 0 and 14 respectively. A score of ≥6 indicates that the risk of developing pressure injury is high. The Cronbach's alpha coefficient of the scale was 0.81.

Procedure

The patients were evaluated using the EFGU Pressure Ulcer Risk Assessment Scale in the first 24 hours of admission, and then they were followed up once a week for 12 weeks, or until they developed pressure injury or they were discharged. Hemoglobin and albumin values of the patients were recorded and averaged for assessment.

Data analysis

The analysis of the data obtained within the scope of the research was performed by an expert specialized in the field of Biostatistics using the Statistical Package for Social Science (SPSS) 16.0 (SPSS Inc., Chicago, IL, USA) program.

Ethical consideration

Before the study was conducted, ethical approvals were obtained from Burdur Mehmet Akif Ersoy University Non-Interventional Research Ethics Committee, permission to conduct the study from Burdur State Hospital where the study was to be conducted and written informed consent from the patients or their relatives who agreed to participate in the study.

Table 1. Patient characteristics.

Gender n (%)	
Female	29 (42.6%)
Male	39 (57.4%)
Age (mean,SD)	67.08±14.35
Follow-up time (mean,SD)	10.66±5.52
Conscious status n (%)	
Normal verbal response	39 (57.4%)
No response	13 (19.1 %)
Pressure sore development n (%)	18 (27.1 %)
EFGU Scale Score (mean,SD)	
Pressure injury developing	8.88±1.23
Pressure injury not developing	3.04±2.46

Results

The mean age of the patients included in the study was 67.08±14.35 years. Of them, 42.6% were women, 17.6% were intubated, and 57.4% had the normal state of consciousness. The rate of pressure injury development in patients was 26.5% (Table 1). While the mean age of the participants who developed pressure injury was 74.83±11.02 years, that of the patients who did not develop pressure injury was 64.30±14.48 years, and the difference between them was statistically significant (p=0.007, t= 2.802).

The mean score the participating patients obtained from the EFGU Pressure Ulcer Risk Assessment Scale was 4.58±3.4. Of them, 41.2% were at risk of developing pressure injury. Of the participants who were at risk of developing pressure injury 64.2% developed pressure injury. All the patients

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who developed pressure injuries were in the at-risk group.

The mean hemoglobin level was 11.86±1.798 in the participants who were at risk of developing pressure injury was, and 12.70±2.39 in the participants who were not at risk. The mean hemoglobin level was low in the participants who were at risk of developing pressure injury, but the difference between the groups was not statistically significant (p=0.132, t=1.524) (Table 2).

The mean albumin level was 3.34±0.48 in the participants who were at risk of developing pressure injury, and 3.72±0.52 in the participants who were not at risk. The mean albumin level was low in the participants who were at risk of developing pressure injury, and the difference between the groups was statistically significant (p=0.003 t=3.032), (Table 2).

The mean hemoglobin level was 11.41±1.75 in the patients who developed pressure injuries and 12.70±2.33 in the patients who did not develop pressure injuries. The difference between the groups was statistically significant (p=0.036, t=2.137), (Table 3)The mean albumin level was 3.35±0.45 in the patients who developed pressure injuries and 3.64±0.54 in patients who did not develop pressure injuries. The difference between the groups was statistically significant (p=0.046, t=2.033) (Table 3).

Table 2. Hemoglobin and Albumin Values According to Pressure Injury Risk.

	Hemoglobin	**Albumin**
Pressure injury risk	**X ± Ss**	**X ± Ss**
Yes (n=28)	11.86±1.98	3.34±0.48
No (n=40)	12.70±2.39	3.72±0.52
	p=0.132 t=1.524*	p=0.003 t=3.032*

*Student t test, Significance level: p<0.05.

Table 3. Hemoglobin and Albumin Values according to Pressure Injuries Development.

	Hemoglobin	**Albumin**
Pressure injury development	**X ± Ss**	**X ± Ss**
Yes (n=18)	11.41±1.75	3.35±0.45
No (n=50)	12.70±2.33	3.64±0.54
	p=0.036 t=2.137*	p=0.046 t=2.033*

*Student t test, Significance level: p<0.05.

Discussion

In our study, the incidence of pressure injuries was 26.5%. The incidence of developing pressure injuries was 27.1% in the study conducted by Efteli and Güneş (2020) in intensive care units, 31.4% in the study conducted by Katran (2015) in a surgical intensive care unit, 15% in the study conducted by Tokgöz and Demir (2010) in a neurology intensive care unit, and 59% in Kıraner et al.'s (2016) study conducted in intensive care units and 28.3% in Tosun and Bölükbaş's (2015) study. Our study results are consistent with those in the literature.

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While the mean age of the patients who developed pressure injuries was 74.83 in our study, it was ≥65 years in other studies (Kurtuluş and Pınar, 2013; Katran 2015; Tokgöz and Demir, 2010; Turgut et al., 2017; Gül et al., 2016). There are also studies in the literature indicating that the risk of pressure injury development increases as the age increases (Perneger et al., 2002; Gunningberg et al., 2001; Halfens et al., 2000; Lindgren et al., 2004; Serpa et al., 2007; Vanderwee et al., 2009; Hatanaka et al., 2008).

In the literature, it has been reported that malnutrition is a risk factor for the development of pressureinjuries, that hypoalbuminemia promotes the development of pressure injuries, and that the incidence of pressure injuries increases especially in patients whose albumin levels are below 3.5 g/dl (Girgin Kelebek ve Erarı Kurhan, 2007; Çınar et al., 2018; Alaca et al., 2001; Anthony et al 2011). Low albumin level causes interstitial edema, and thus accelerates the development of pressure sores and delays wound healing. In our study, pressure injuries developed in the patients whose albumin level was 3.35±0.45 (reference value: 3.5-5.2 g/dl). On the other hand, in Ersoy et al.'s (2013) and Terekeci et al.'s (2009) studies conducted with intensive care patients, of the patients, those whose serum albumin level was lower than 2.5 g/dl developed pressure injuries. In their study Inozu et al. (2012), determined that the albumin level was 2.53±0.25 g/dl in older patients who were hospitalized for surgical treatment and developed pressure injuries. In studies conducted with different patient groups, it was determined that the average albumin level of the patients who developed pressure injuries was lower (Kıraner et al., 2016; Tosun and Bölüktaş, 2015; Tokgöz and Demir, 2010). In Kurtuluş and Pınar's (2013) study, although the albumin level was low in the group with pressure sores, no statistical relationship was determined between the albumin level and the development of pressure injuries.

When the hemoglobin level is lower than 12 g/dl, oxygen carrying capacity of the blood and tissue resistance decrease seriously, and ischemia occurs. If ischemia is accompanied by anemia, cell metabolism is at a greater risk. Low hemoglobin level increases the risk of pressure injuries (Fogerty et al., 2008 Jaul 2001; Williams et al., 2001), and the hemoglobin level lower than 10 g/dl facilitates pressure injury development and makes it difficult to heal (Ersoy et al., 2013; Ullah and Alam, 2012). In our study, the mean hemoglobin level of the patients who developed pressure injuries was 11.41±1.75 (reference value 11.7–15.5 g/dl). In Tosun and Bölüktaş's (2015) study, the mean hemoglobin level was 10.1±2.0 in the group with pressure injuries. In a study conducted with 40 patients with pressure injuries, it was determined that injury healed in parallel to the treatment of anemia (Fuoco et al., 1997). Kıraner et al. (2016) determined that the hemoglobin level of the patients who developed pressure injuries in the intensive care unit was 7.6 g/dl. However, in some studies, it is reported that anemia does not affect the development of pressure injuries (Kurtuluş and Pınar 2013; Alaca et al., 2001)

On the other hand, in their prospective study conducted with 210 intensive care patients, Tsaras et al. (2016) determined that a one-unit increase in hematocrit reduced the formation of pressure injuries by 9%. In our study, the hemoglobin levels of the patients who developed pressure injuries were lower than were those of the patients who did not develop pressure injuries

In our study, the assessment of the patients with the EFGU Pressure Ulcer Risk Assessment Scale demonstrated that all the patients who developed pressure injuries constituted the group at risk of developing pressure injury. The mean hemoglobin and albumin levels of the patients in the at-risk group for the development of pressure injuries were 11.86±1.798 and 3.34±0.48 respectively. No statistical relationship was determined between the hemoglobin levels and the EFGU Pressure Ulcer Risk Assessment Scale scores, but the albumin level was low in the group with pressure injury risk, and the difference between the groups was statistically significant. In Anthony's (2011) study, hemoglobin and albumin levels of the patients in

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the risk group were determined as low with the Waterlow Risk Assessment Scale.

Conclusion

In our study, hemoglobin and albumin values were lower in patients with pressure injuries hospitalized in intensive care clinics than were those of the patients without pressure injuries, the incidence of pressure injuries was 26.5%, and the incidence of pressure injury development was higher in patients who were at risk of developing pressure injuries according to results of the EFGU Pressure Ulcer Risk Assessment Scale. To reduce the incidence of pressure injuries in intensive care units, albumin and hemoglobin levels, which are among the nutritional parameters, should be carefully monitored in terms of pressure injurydevelopment and wound healing, patients who are at risk should be identified in the early period using risk assessment scales, and protective measures should be taken in at-risk patients.

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