

# Investigation of the risk factors of pressure ulcers in intensive care unit patients: According to the Braden Scale\*

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## ABSTRACT

The study was planned as a descriptive study investigating the frequency of pressure ulcers in intensive care units and the correlation between pressure ulcers and Braden risk factor scores.

A total of 414 patients who were admitted to the stated intensive care units between October 1, 2008 and January 4, 2010 were evaluated. Among those, 323 patients met the inclusion criteria and were included in the study. The Braden Risk Assessment Scale was used for risk evaluation.

The incidence of pressure ulcers in the intensive care units was 17.0% (n=55). According to the Braden Risk Assessment Scale, only 12.3% (n=40) of the patients had no risk of pressure ulcer development. The incidence of pressure ulcer development in the internal medicine intensive care unit was significantly higher than that of surgical medicine intensive care unit (p=0.00). Anemic patients with a long duration of hospital stay, low level of albumin, and who were hospitalized in the internal medicine intensive care unit were determined to be statistically significantly at "very high risk" of pressure ulcer development (p<0.05). A statistically significant correlation was observed between the risk levels of the patients and pressure ulcer development (p=0.04).

According to the results of this study, the duration of hospital stay, immobility, obesity, unconsciousness, friction, and rupture parameters are risk factors that lead to the development of pressure ulcers.

**Key Words:** Pressure ulcer, intensive care unit, Braden Risk Assessment Scale, risk factors

## Introduction

Pressure ulcers (PUs) are recognized worldwide as one of the five most common causes of harm to patient, a largely preventable patient safety problem. PU are increasingly described as an indicator of quality of the care in intensive care units (ICUs) by health care organizations (1).

PUs are commonly defined as pressure or rupture related localized wounds in the skin over the bony process and/or the tissues beneath (2). Currently, PUs continue to be a serious health problems that increases the risk of infection, patient suffering, treatment costs and length of stay in ICU, furthermore, PUs also reduce the quality of life for the patient (3-5). Although the prevention and treatment of PUs necessitates a multidisciplinary

team approach, everybody is like-minded in their opinion that nurses are foreground in preventing PUs (6,7). Furthermore, PUs are an indicator of the quality of the nurse-specific provided by health care organizations (8-10).

In studies conducted before 2008-2009 reveal a reduction in the prevalence of PUs in hospitals (4%-20%), (4,11-14). However, the prevalence of PUs in intensive care units varies between 9% and 42% which is still frequent (15).

The number of studies on the prevalence and incidence of PUs in intensive care units is limited in our country. The incidence of PUs in the neurology intensive care unit was reported to be 18.3% in the study of Kurtuluş and Pınar (16), 4.8% in the surgery intensive care unit in the study of Karadağ and Gümüşkaya (17), 11.6% in the

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study of Uzun and Tan (18), 14.3% in the study of Sayar et al. (19) and 10.4% in the study of Inan and Oztunc (20). Therefore, risk assessment is very important to identify of patients who are at high risk of developing PU in ICUs, in order to encourage effective PU management (21,22).

PU risk assessment scales recently are used widespread in ICUs for preventing PUs in the patients (22). In various studies examined validity and reliability of the following scales such as Braden and Waterlow (21). PU risk assessment scales recently are used widespread in ICUs for preventing PUs in the patients (22). In various studies examined validity and reliability of the following scales such as Braden and Waterlow (21). Although the importance of using PUs risk assessment scales and incidence rates in ICU is highest, risk assessment scales are not widely used in Turkey (8,23). In studies conducted in Turkey demonstrate that only 10-17% of nurses have used the Risk Assessment Scales of Braden and Norton (8,23). The most frequently used scale in the States is the Braden scale (15,23). The most frequently used scale in the United States is the Braden Scale (15,24). In studies showed that the Braden scale has the highest validity in ICU patients and detailed explanations of risk factors comprising the Braden Scale (15,25,26). Therefore, this study was selected the Braden Scale to identify patients at level of risk for development of PU in ICUs.

This study was planned due to the limited number of the incidence of PUs studies in Turkey. The purpose of this study was to determine incidence, risk factor for PUs development in ICU patients according the Braden Scale.

## Materials and method

### *Sample*

The study was conducted as a descriptive and prospective study in the Medical and Surgical ICUs of a university hospital between 1 October 2008 and 4 January 2010. Each ICU had five bed unit in which eight nurses worked. Patients were included if they were 18 years or older and had an the Medical and Surgical ICUs stay of 24 hours or greater. 91 patients did not meet study criteria for multiple reasons and were excluded. After the first evaluation, patients who met the criteria were included in the study. PU risk was evaluated by the Braden Scale. Risk factors identified in this assessment led to an individualized plan of care to minimize the effects of friction and shear, sensory perception, general health status, and body

temperature. The study was completed with a total of 323 patients. The study was planned as a descriptive and analytic study.

This study was approved by the institutional review Afyon Kocatepe University. Written approvals to perform the study were received from the Ethics Board of the Ege University School of Nursing and the University Hospital Medical and nursing directors of Research and Practice Hospital. For patients who were unconscious, written consent was obtained from relatives.

### *Data Collection*

**Data collection form:** The data collection form, which was prepared by investigators to determine characteristics of patient, was used for documenting sociodemographic and medical conditions that could be PU risk factors, including age, gender, height and body mass index (BMI) of the patients, the ICU of admission, length of stay, levels of albumin and haemoglobin, drug treatment received, presence of any systemic disorders and level of consciousness. The patients' level of consciousness was evaluated using the Glasgow Coma Scale (GCS). The GCS gave a total consciousness score between 3 and 15, which was obtained from three parameters including (I) Eye response, (II) verbal response, (III) and motor response. A score of 3 indicates the "worst" and a score of 15 indicates the "best" consciousness level. Score of less than 8 on the GCS demonstrates "severely damaged". Scores between 9-12 demonstrates "moderately damaged" and scores between 13-15 defines "mildly damaged" consciousness (27). BMI is obtained by dividing the body mass by the square of the height. A BMI of less than 19 score symbolized "thin", 19 - 24.9 is "normal", 25 -30 is "fat", and >30 is "obese".

**Braden Scale:** The Braden Scale for predicting PU risk, is a instrument that was developed in 1987 by Barbara Braden and Nancy Bergstrom. The purpose of the scale is to help health professionals, especially nurses, assess a patient's risk of developing a PU (16,23,28). The Braden Scale is composed of six subscales that reflect sensory perception, skin moisture, activity, mobility, friction and shear, and nutritional status. Each subscale is rated on a scale of 1 to 4, excluding the 'friction and shear' category which is rated on a 1-3 scale (28,29). This combines for a possible total of 23 points, with a higher score meaning a lower risk of developing a PU and vice-versa. A score of 23 means there is no risk for developing a PU while the lowest possible score of 6 points represents the severest risk for

developing a PU. Patients with a total score of 12 or less are defined to be at high risk of PU development, those with a score between 13-14 are defined to be at moderate risk and those with a score between 15-16 are defined to be at low risk. In the elderly, at 75 years of age or older, a score between 15-18 is accepted as low risk (16,24,28,30). The validity and safety study for this scale was first conducted stage by Oguz in Turkey and was repeated by Pinar and Oguz in Turkey and the reliability and the validity of the scales were found to be quite high in both (16,24). The Cronbach's alpha value was determined to be 0.98 in this study.

**Pressure Ulcer Assessment Form:** Patient's skin were assessed regularly to check for signs of PU development by nurses. In addition, for patients in whom a PU developed, the number of hours into the admission the PU occurred and the anatomical location and stage of the PU according to the 2009 National Pressure Ulcer Advisory Panel (NPUAP) staging system were recorded (31). The most widely used PU classification guideline recently classifies PUs in four stages system. According to that classification, in Stage I, intact skin with non-blanchable redness of a localized area usually over a bony prominence. In Stage II, partial thickness loss of dermis presenting as an intact or open/ruptured serum-filled or sero-sanguinous filled blister. Full thickness tissue loss is observed in Stage III. Slough may be present but does not obscure the depth of tissue loss. In Stage IV, Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present (31).

### **Data analysis**

Data was analysed the SPSS 14.0 package program. Descriptive statistic included frequency distributions for study variables and sociodemographic data. All comparisons were undertaken on an item by item basis and differences assessed by chi-square. The level of statistical significance was accepted as  $p < 0.05$ .

### **Results**

In this study, the risk factors of patients were evaluated according to the Braden Scale. Of the 414 patients admitted to the Medical and Surgical ICUs during the study period, 323 met inclusion criteria and were in the final sample. The mean age of the 323 patients was  $61.02 \pm 18.48$  years and 66.3% were over 60 years of age. Among the patients accepted in the ICUs, 44.6% were female and 55.4% were male. The mean length of stay in

the ICU was  $7.7 \pm 12.5$  days. 71.8% of patients stayed between 3 and 16 days in ICU. When the BMI values of the patients, 4.0% were cachectic, 37.1% were obese, 24.1% had a normal body weight, 21.0%. The activities for 35% of the patients dependent, 6.8% partially dependent, 22.9% uncooperative, 19.2% were moderately cooperative, 21.5% were anemic, 75.9% had a low albumin level, 17% received sedation, and 17% received cortisone therapy (Table 1).

In the evaluation of Braden scores of the patients, 40.8% were classified as at risk, 20.7% as at moderate risk, 16.4% as at high risk and 8.9% were as at very high risk. The rate of PUs development increased with an increase in the risk level of the patients according to the Braden Scale. This correlation was statistically significant (Table 1;  $p = 0.04$ )

Independent variables significantly associated with the dependent development of PU were assessed in this study. No statistically significant difference was found for PU development according to patients' age and gender. ( $p > 0.05$ ). There was a statistically significant correlation found between length of stay and PU development ( $p < 0.05$ ). 29.7% were treated in the medical intensive care unit, and 70.3% were treated in the surgical ICU. The PU development rate in the Medical ICU was significantly higher than that in the Surgical ICU ( $p = 0.00$ ). A statistically significant difference was found in the 37.1% obese patients, (Table 1;  $p = 0.03$ ). Mobility and GCS were found to have a statistically significant difference for PU development ( $p < 0.05$ ). In addition, there were no statistically significant differences found for PU development according to level of anemic, diabetic, sedated, albumin and using cortisone (Table 1;  $p > 0.05$ ).

This study investigated the correlation between the PU development and the Braden Scale subscales. The sensory perception subscales, and friction and rupture subscales were the Braden Scale that were found to have a statistically significant relationship with PU development (Table 2;  $p < 0.05$ ).

The incidence of PUs in patients at risk for PU according the Braden Scale in ICUs this study was observed in 17% of the patients. Stage I PUs developed in 13% patients, Stage II developed in 4.3%, Stage III developed in 0.3%, and no Stage IV PUs developed in any of the patients (Table 3). The PUs were observed mostly in the sacral (49.5%), scapula (20.0%), trochanter (14.1%) and malleolus (5.7%) regions (Table 3).

**Table 1.** The relation between PUs and baseline clinical details of patients

Clinical details of patient	n (%)	New Development PUs (n)	No Development New PUs (n)	p
<b>Years</b>				
60 and < years	109 (33.7)	14	95	p=0.10
60 >years	214 (66.3)	41	173	
<b>Gender</b>				
Female	144 (44.6)	29	115	p=0.10
Male	179 (55.4)	23	153	
<b>Length of stay</b>				
3-16 days	232 (71.8)	12	220	
17-30 days	46 (14.2)	13	33	p=0.00
31-44 days	18 (5.6)	14	4	
45 ≥ days	27 (8.3)	16	7	
<b>Admission ICU</b>				
Surgical ICU	227 (70.3)	29	67	p =0.00
Medical ICU	96 (29.7)	26	201	
<b>BMI</b>				
Unkonwn	112 (34.6)	9	93	p=0.03
<18.4 =underweight	13 (4.0)	6	7	
18.5-24.9=normal weight	78 (24.1)	13	65	
25 >=obesity	120 (37.1)	17	103	
<b>Mobility</b>				
Immobile	35 (10.8)	2	33	p=0.01
Bed rest/ equipment assist	22 (6.8)	2	20	
Crutches/walker	72 (22.2)	7	35	
Mobile/active	110 (34.0)	18	92	
Nurse assist	114 (35.2)	26	88	
<b>Braden Score</b>				
19-23 score=No risk	40 (12.3)	0	40	p=0.04
18-15 score =risk	132 (40.8)	22	110	
14-13 score =moderate risk	67 (20.7)	14	53	
10-12 score =high risk	53 (16.4)	12	41	
≤ 9 =very high risk	29 (8.9)	7	22	
<b>Glasgow Coma Score</b>				
13-14 score=Minor	187 (57.9)	24	163	p=0.02
12-9 score=Moderate	62 (19.2)	13	49	
8-3 score=Severe	74 (22.9)	18	56	
<b>Cortisone drug Use</b>				
Yes	58 (17.9)	7	4	p=0.40
No	265 (82.0)	48	217	
<b>Sedation drug use</b>				
Yes	58 (17.9)	15	43	p=0.10
No	265 (82.0)	40	225	
<b>Diabetes Mellitus</b>				
Unknown	27(8.3)	6	21	P=0.60
Yes	88(27.2)	13	75	
No	280(86.6)	36	172	
<b>Albumin (g/dl)</b>				
<3.5 gr/dl	245 (75.9)	41	204	p=0.30
3.5 gr/dl≥	78 (24.1)	14	62	
<b>Haemoglobin level (g/dl)</b>				
Unknown	75 (23.2)	5	70	p=0.30
<10 g/dl	68 (21.05)	10	58	
10 g/dl≥	230 (71.3)	40	190	
<b>Total</b>	<b>323 (100)</b>	<b>55</b>	<b>323</b>	

In this study, PU development was observed in 17% (n=55) of the patients. I. stage PUs developed in 42 (13%) patients, II. stage developed in 14 (4.3%), III. stage developed in 1 (% 0.3), and no IV. stage PUs developed in any of the patients (Table 3). The PUs were observed mostly in the sacral (49.5%), scapula (20.0%), trochanter (14.1%) and malleolus (5.7%) regions (Table 3).

#### 4. Discussion

The Braden Scale showed to have best in a number of widely used scales for assessing risk of PU in ICUs. The purpose of the scale is to help health professionals, especially nurses, assess a patient's risk of developing a PU (15) The risk of PU development as defined in this study, score

according to the Braden Scale was less than or equal to 18. The scores decreased with an increase in the risk of PU development. Preventive measures taken generally similar according to the scores obtained in the Braden Scale, only small differences may be observed between the groups of different risk levels (23).

The incidence of PUs in patients at risk for PU according to the Braden Score in ICUs in this study was found to be 17.0%. PU incidence is not high compared with studies in other countries in which the incidence of PU in ICU patients has been reported to be between 3–33% (11,19,32).

All of the patients who were diagnosed with PUs were patients at 'high risk', 'very high risk' and risk according to the Braden score. This is also supported by our finding that none of the patients in the 'no risk' group developed a PU (Table 1).

**Table 2.** The relation between PU and baseline Braden Subscales scores of patient

Braden Risk Assessment	n (%)	New Development PUs n	No Development New PUs n	p
<b>Sensory perception</b>				
Completely limited	76 (23.5)	18	58	<b>p=0.04</b>
Very limited	22 (6.8)	7	15	
Slightly limited	59 (18.2)	10	49	
No impairment	167 (51.7)	20	147	
<b>Moisture</b>				
Completely moist	2 (0.6)	0	2	<b>p=0.20</b>
Very moist	2 (0.6)	0	2	
Occasionally moist	2 (0.6)	0	2	
Rarely moist	270 (83.5)	52	218	
<b>Activity</b>				
Bedfast	298 (92.2)	55	243	<b>p=0.20</b>
Walks occasionally	24 (7.4)	0	24	
<b>Mobility</b>				
Completely immobile	22 (6.8)	20	2	<b>p=0.60</b>
Very limited	65 (20.1)	10	55	
Slightly limited	83 (25.6)	17	66	
No limitation	91 (28.1)	8	83	
<b>Nutrition</b>				
Very poor	45 (13.9)	12	33	<b>p=0.20</b>
Probable inadequate	91 (28.1)	16	75	
Adequate	182 (56.3)	27	155	
Excellent	5 (1.5)	0	5	
<b>Friction and shear</b>				
Problem	130 (40.2)	28	102	<b>p=0.03</b>
Potential problems	111 (34.3)	21	90	
No apparent problems	82 (25.3)	6	76	
<b>Total</b>		<b>323</b>		

**Table 3.** Overview incidences by stage and location

Location	I. stage n (%)	II. stage n(%)	III. stage n(%)	Total n(%)
Sacrum	16 (15.2)	9 (9.5)	-	25 (49.5)
Scapula	16 (15.2)	5 (4.8)	-	21 (20.0)
Trokanter	4 (3.8)	4 (3.8)	1 (1.0)	9 (14.1)
Malleol	6 (5.7)	-	-	6 (5.7)
Others	16 (15.2)	-	-	16 (15.2)

Similarly, Sayar et al. (19) found the mean another a risk score instrument of patients developing a PU that according to the Braden score classification, indicates 'very high risk'. that the Braden score has been shown to have predictive ability for patients in an ICU. Of the six subscales, only sensory perception, and friction and rupture subscales were a significant predictor of PUs in this study. Mobility is defined on the Braden Scale as ability of patient to turn and control body movement. This study, compared with patients whom were no PU, patients in whom PU developed had significant lower scores on the mobility subscale, defined as very limited mobility (15). The result are consistent with others reported in the literature (11,15,33).

PU development within the Surgical ICU was statistically higher than Medical ICU. In the Surgical ICU, one of the surgery-related risk factors is having an extended period of pressure during the surgical procedure, remaining wet, metabolic and circulatory changes related to the surgical procedure and anaesthesia (19).

There were 77 PUs developed in total of 57 patients. Stage I PUs were observed in 13% patients, Stage II in 4.3% patients, and Stage III in 3.0% patient. That stage of the Pus were the same throughout the study. It was observed that the majority of new PUs were Stage I. In Sayar et al. (19) study conducted in Turkey, 23 of 140 patients had Stage I PUs, and 4 patients had Stage II PUs. In other study, the more severe PUs were reported to be in ICUs, of which 42% were Stage II and 28.5 % - were stage I in ICU (25).

The distribution according to PU regions revealed that Stage I and Stage II PUs were mostly observed in sacrum and followed by scapula in this study. The reasons for this may be the fact that the majority of patients are kept in a semi-fowler's position, which puts more pressure on the sacrum and shoulder and because of an increase in friction and shearing from incorrect lifting techniques of the patients slipping downwards in the bed by healthcare givers (19).

Although PUs may be observed at any region of the body, 95% are observed in the sacrum parts. Although studies have shown differences between the rates of PU location, the most frequently observed locations are sacral, trochanteric, ischium, and malleolar regions (15,19,34,35). Otherwise the malleol and heel were found as sites of PUs in this study. This result has not been approved yet by other studies and could be noted in futher research (25).

In this study, showed no significant relationship between PU and age. It has been reported in literature that, due to impairment in the skin turgor and frequent chronic diseases, an increased risk of PU development in the elderly (65 years of age or older) was observed, which reached an Evidence C level (26,28). The rate of PU development in the same age group is high according to the existing literature. The studies of Kurtuluş and Pınar (16), Sayar et al. (19), Bergstom et al. (28), Chan et al. (36) also revealed no significant difference between age groups and development of PUs.

Gender was not a PU risk factor in this study. However, other studies demonstrate higher rates of PU development in women than men (19). According to the EPAUP guidelines, age and gender parameters are factor in the development of PUs (31). In similar to studies, gender was not found to be a factor affecting PU development (16,19,37).

The findings showed that a significant correlation was observed between PU development and the length of stay, confinement to bed, and poor consciousness. In similar studies, the duration of hospital stay among the patients with PUs was determined to be longer, and a positive and highly significant difference was found between PU development and the length of stay (16,38). In this study, standing the patient on his or her feet during the day was considered active movement. The causes of PUs frequently observed in intensive care patients includ insufficient physical

activity and movement, confinement to the bed for a long time, conventional use of various drugs such as anesthetics, sedatives, analgesics and muscle relaxers, and the use of mechanical ventilation. Due to unconsciousness and drug use, the patients cannot perceive the increased tissue pressure and cannot react so as to request the alleviation of the pressure (39).

Additionally, there was significant difference between the BMI values, PUs were statistically significantly more common among the “obese” population. The existing literature reports that PU development is more common among patients with a BMI value not within the normal limits (40). In obese patients, PU development is increased though many causes including the reduced tolerance against friction due to poor circulation within the fat, difficulties in turning and positioning the patients, and an increase in moisture in the curves of the skin (2,16,38,40). According to these results, obesity was defined as a risk increasing factor in this study.

No statistically significant correlation was observed between PU development and hemoglobin (H<sub>g</sub>) levels, albumin levels and diabetes (Table 1). It has been reported in literature that an Evidence C level diabetes, anemia, and hypoalbuminemia are factors that increase the risk of PU development (31). In a large population studies reported anemia as a causative factor in the development of PUs (40). However, there are Kurtuluş & Pınar (16) and Sayar et al. (19) studies indicating no correlation between anemia and PU development. In some studies, serum albumin level was defined as a risk factor (37, 41,42).

Two different types of viscoelastic foam mattresses were the preventive devices most frequently applied to patients in ICUs. No difference was observed between the viscoelastic mattresses regarding the development of PUs in ICUs. The use of specialized mattress to prevent PUs is common in the ICU, although indications are largely anecdotal. Some studies suggest that they are beneficial but only to populations outside the ICU environment. Findings are often extrapolated to critically ill patients (25). The use of specialized foam mattresses and regular turning and repositioning of immobile patients may be two important care for preventing PU (15). The most important factor in reducing the pressure on the tissue is the interval of turning the patient (15,32). During the study, the routine prevention measures taken in ICU for reducing PUs is repositioning and turning the patient. This standard procedure should be performed once

every two hours, however, the repositioning may be performed at impaired intervals due to the working hours of nurses in ICU (32). Furthermore, patients skin should be wiped a minimum of two times daily, and preventive applications should be performed for fecal or urinary incontinences (7). Therefore, in this study, patient skin care was performed two times daily by nurses, their skin was moisturized with vaseline, and the patients were repositioned once every two hours. Independent from the investigators, nurses reported their observations regarding patients skin during their care.

Braden subscales, sensory perception, and friction and rupture subscales were identified as being predictive of PUs development in this study. Furthermore, a statistically significant correlation was observed between the duration of PU development and higher risk score, elderly, unconscious and immobilized and length of stay in bed. In addition to this study result, none of the patients in the ‘no risk’ group developed PUs. According to this results of study, Braden Scale is recommended to reduce development PU and define better prediction of PU for giving more effective nursing care patient with risk factor in ICU.

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