Is Braden Scale Reliable and Sufficient to Evaluate the Risk of Pressure Ulcer Occurrence in Level 3 Intensive Care Unit Patients?

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ABSTRACT

Objective: To prevent pressure ulcer, detecting risk factors and planning how to act with respect to patients provide to find solution. Thus, Braden Scale is the most common tool that is used in Turkey. This study aimed to measure Braden Scale effectiveness at detecting the risk groups of level 3 intensive care unit patients.

Methods: This prospective, single-center study includes 206 level 3 intensive care unit patients whose risk factors were standardized as much as possible in the intensive care unit between January 2014 and May 2015. Routine clinical care was applied to the patients whose risk groups were determined by Braden Scale, and the patients were divided into two groups depending on the presence of a pressure ulcer before discharging from the hospital. Demographic findings, hospitalization duration, mental status, Apache II score, expected/actual mortality, blood albumin levels, and Braden Scale score were compared.

Results: Comparison of the groups showed that patients' age, length of stay in intensive care unit, mental status, and blood albumin levels are significantly different between patients with and without pressure ulcers. Furthermore, scores of patients with pressure ulcers were not significantly different from those of patients without pressure ulcers. Data also illustrated that pressure ulcers occurred in no risk patients with the ratio of 7.14%; in low-risk patients with the ratio of 27.8%; in moderate-risk patients with the ratio of 29.73%; in high-risk patients with the ratio of 17.72%.

Conclusion: Data evaluation demonstrates that Braden Scale is not effective to detect the risk factors, and parameters related to pressure ulcer development are not sufficiently represented by Braden Scale. Modification of an existing scale or a new risk assessment scale that includes all other risk parameters and that is more suitable for the patients of our country is required. *(JAREM 2016; 6: 98-104)*

Keywords: Braden Risk Assessment Scale, pressure ulcer, intensive care unit

INTRODUCTION

Pressure ulcers are localized damages occurring in the skin and/or subcutaneous tissues (1). This condition usually develops in the areas over bony prominences of the body depending on the exposure to constant pressure, peeling, and friction of the skin or combinations of these (1-3). The back of the head, shoulder head, elbow, lower back, hips, pelvic bone, ankle, and heel are the parts of the body where pressure ulcers are widely seen (4).

The incidence of pressure ulcers in intensive care units is reported to be between 8.8% and 53.2% in different studies (5, 6). Pressure ulcers cause the patient to feel pain, delay the treatment of the primary disease, and reduce the quality of life after discharge. This situation is an important health problem that increases treatment costs and reduces patient comfort, and it is a major health problem, particularly in countries with limited resources allocated to health in terms of the global budget (7, 8).

Determining the situation and developing the action plans for patients by determining the possible risk groups directly contribute to resolving the problem in terms of the prevention of pressure ulcers. The scale that is still most commonly used in Turkey and in many other countries and that is said to be the most reliable and valid scale for patient groups of a wide age range is the "Braden Risk Assessment Scale (BRDs)" (8-14).

In this study, we aimed to determine the validity of the Braden Scale in determining the risk groups of pressure ulcers in level 3 patients treated in the intensive care unit (ICU).

METHODS

In total, 206 level 3 patients who met the following parameters in the intensive care unit between January 2014 and May 2015 were included in our prospective, single-center study:

- Those who were over 18 years of age,
- Those who had a body mass index (BMI) between 18.5 and 24.9,
- Those who had taken at least 120 hours of mechanical ventilation treatment,

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- Those in whom no pressure ulcers were detected in the first examination,
- Those who did not need continuous sedation/analgesia, except for short-term, low-dose bolus administration, and
- Those whose albumin levels did not fall below 2.5 during the treatment.

Patients who did not comply with these parameters or went out of these parameters during the follow-up were excluded from the study. Written informed consent was obtained from the patients and/or their first-degree relatives after providing them detailed information about the study. In addition, the consent of the hospital ethics committee was provided before the study.

The age, sex, BMI, duration of hospitalization, and first 24-hour Apache II scores of the patients (n=206) who met the acceptance criteria and participated in the study were recorded. Risk assessment of these patients was made according to BRDs for pressure ulcers within the first 8 hours of admission to the ICU (Table 1). Individuals with BRD scores of 12 points or lower were considered at high risk (BRDs 3) for the development of pressure ulcers, those with scores of 13–14 points were considered at medium risk (BRDs 2), and those with scores of 15–16 points were considered at low risk (BRDs 1). While scores of 15–18 were accepted as indicating the low-risk group in people at 75 years of age and older, those with points over 18 and those who got more than 16 points in the group of "below 75 years of age" were accepted as riskless (BRDs 0) (15). After the routine service, follow-up procedures (putting in position every 2 hours, using supportive pillows etc., and various medical products) were applied to the patients, and whether or not there was a pressure ulcer at the time of discharge was noted, and if there was one, its degree (if there are multiple pressure ulcers, the worst value was taken) at that time and place were noted.

The degree of pressure ulcers was classified as stage 1 to 4 (1), whereby;

- Stage 1: The presence of erythema by pressing the skin without disrupting the integrity of the skin,
- Stage 2: Tissue loss at partial depth affecting the epidermis and/or the upper layer of the dermis,
- Stage 3: Full depth of tissue loss, containing all the tissues starting from the epidermis to the upper fascia and/or the development of necrosis, and
- Stage 4: Along with the full depth of tissue loss, the progress of the necrosis under the fascia, to the bone tissue, to the tendons, and up to the supporting structures, such as the joint capsule.

Statistical Analysis

SPSS 15.0 for Windows program (Statistical Package for the Social Sciences Inc.; Chicago, IL, USA) was used for the statistical analysis of the data. The descriptive statistics were given as numbers and percentages for the categorical variables and as the average, standard deviation, minimum, and maximum for the numeric variables. The rates of the categorical variables in the independent groups were compared by Chi-square analysis and the other groups were compared with the unpaired Student's t-test. The statistical alpha significance level was considered as a p value smaller than 0.05 ($p<0.05$).

RESULTS

A total of 206 patients, comprising 88 women (42.7%) and 118 males (57.3%), who were accepted in the study were treated in the ICU for an average of 18.5±12.8 days (min=5; max=117). The average age of the patients was 64.1±19.8 (18–99) years. The mean BMI of the patients was 21.8±3.82 (18.8 to 24.4). The worst average Apache II score that was detected within the first 24 hours was 16.5±7.8 (4-39) and the expected mortality rate was found as 26.6±19.8% (3.3 to 89.8). While 133 of the patients (64.6%) were conscious and could be communicated with, 73 of them (35.4%) were confused or unconscious and no communication could be achieved. During the stay in ICU, all the patients were followed and treated in accordance with the conventional intensive care treatment protocols for the primary and developing secondary pathologies. While 135 (65.5%) of the patients who were treated were discharged, 71 of (34.5%) them died. The gender, age, BMI, duration of hospitalization, diagnoses, Apache II scores, level of consciousness, plasma albumin values, and expected-actual mortality rates of the patients are summarized in Table 2.

In the assessments made according to the BRDs within 8 hours following the admission of the patients to the ICU, 42 (20.38%) patients were evaluated as riskless (BRD 0), 48 (23.31%) patients as low risk (BRD 1), 37 (17.96%) patients as intermediate-risk (BRD 2), and 79 (38.35%) patients as high risk (BRD 3). The mean BRDs was calculated as 13.5±3.6 (5–23).

At follow-up and/or discharge, a pressure ulcer was found in a total of 41 (19.90%) patients, 23 (56.1%) of whom were men and

Table 1. Braden risk assessment scale

Control parameter/score	1	2	3	4
Perception of the stimulus	Totally inadequate	Very inadequate	A little adequate	Completely adequate
Wetness	Constantly wet	Very wet	Sometimes wet	Rarely wet
Activity	Bedridden	Chair dependent	Can sometimes walk	Can often walk
Movement	Completely immobile	Very immobile	A little mobile	Mobile
Nutrition	Very bad	Inadequate	Adequate	Very good
Friction and irritation	Problem	Potential problem	No problem	

High risk: ≤12; Moderate risk: 13–14; Low risk: 15–16 (age>75 years, 15–18); No risk: >16 and >18 (age>75 years).

18 (43.9%) of whom were female. Similar gender discrimination was found in patients without pressure ulcers (93 men, 56.36%; 72 women, 43.64%). While the average age of the patients with a pressure ulcer was 71.08±18.7 years, it was 63.8±20.4 years in patients without a pressure ulcer. The difference between them was found to be statistically significant (p=0.043, p<0.05). While the BMI of the patients with pressure ulcers was found to be 22.6±2.96, it was 21.4±3.11 in those without a pressure ulcer. The difference was not statistically significant. While the patients with pressure ulcers stayed in hospital for 25.14±9.87 days on average, patients without pressure ulcers received treatment for 13.24±6.73 days. The difference between the groups was found to be statistically significant (p=0.002, p<0.05). While 19 (14.28%) of the patients in whom pressure ulcers developed were conscious and could be communicated with, 114 (85.72%) of those without pressure ulcers were found to be conscious. Twenty-two (30.14%) patients with pressure ulcers and 51 (69.86%) patients without pressure ulcers were found in the group of those who had confused consciousness or those who were unconscious and could not be communicated with. The average Apache II value was calculated as 17.65±7.2. The Apache II value was found to be 16.23±8.1 in the group of patients who were treated at the intensive care unit and in whom a pressure ulcer did not develop. Although the Apache II value of the group in which pressure ulcers developed was higher than that of the group in which they did not develop, there was no statistically significant difference (p=0.303 p>0.05). While the mean of serum albumin values was 3.39±0.71 mg/dL in all patients, it was 2.87±0.73 mg/dL in the group with pressure ulcers and 3.54±0.62 mg/dL in those without pressure ulcers. The difference between them was statistically significant (p=0.029, p<0.05). While BRDs was detected as 13.6±3.1 in patients with pressure ulcers, it was 13.1±3.7 in patients without pressure ulcers. The difference was found to be statistically insignificant. The comparisons of patients with and without pressure ulcers are shown in Table 3.

Table 2. Age, sex, BMI, duration of hospitalization, diagnoses, Apache II scores, state of consciousness, albumin, and expected–actual mortality rates of patients

Patient characteristics (n)		206
Age (years) (mean ± SD/min–max)		64.1±19.8 (18-99)
Gender (n/%)	Male	118 (57.3%)
	Female	88 (42.7%)
Body mass index (BMI) (mean ± SD/ min–max)		21.8±3.82 (18.8-24.4)
Duration of hospitalization (days) (mean±SD/min–max)		18.5±12.8 (5-117)
Primary diagnoses (n/%)	Acute respiratory failure	97 (47.1%)
	Neurological pathologies	64 (31.1%)
	Multiple organ failure	22 (10.65%)
	Polytrauma	17 (8.25%)
	Other	6 (2.9%)
State of consciousness (n/%)	Open	133 (64.6%)
	Stupor-coma	73 (35.4%)
Apache II (mean ± SD/min–max)		16.5±7.8 (4-39)
Expected mortality (%)		21.1 (4-85)
Plasma albumin (g/dL)		3.39±0.71
Prognosis (n/%)	Discharged	135 (65.5%)
	Died	71 (34.5%)

n: number; mean: arithmetic average; SD: standard deviation; min: minimum value; max: maximum value

Pressure ulcers developed in 3 (7.14%) of 42 patients who were not under risk according to BRDs, in 13 (27.8%) of 48 low-risk patients, in 11 (29.73%) of 37 intermediate-risk patients, and in 14 (17.72%) of 79 high-risk patients. Stage 1 pressure ulcers were found in 11 (26,19%) patients, stage 2 in 13 (30.95%), stage 3 in 10 (23.81%), and stage 4 in 8 (19.05%) patients out of 42 patients in whom a pressure ulcer developed. Of these pressure ulcers, 17 (40.48%) occurred in the sacrum, 14 (33.34%) in the gluteus, 3 (7.1%) in the ischial region, 2 (4.76%) in the trochanteric region, 1 (2.38%) in the heel, and the other 5 (11.9%) in more than one region.

DISCUSSION

A pressure ulcer is the damage in the skin and subcutaneous tissue that is usually observed over bony prominences and is caused by pressure or friction alone or by pressure together with a tear. It usually occurs within 2 weeks after hospitalization (5).

The risk of the development of pressure ulcers in patients treated in the intensive care unit is higher than with the other patient groups. The loss of consciousness, mechanical ventilation, physical activity limitation, prolonged bed dependence, the use of sedatives-analgesics and muscle relaxant drugs, metabolic problems, circulatory problems, and frequent problems in the control of urine/defecation can be considered among the risk factors of pressure ulcers in these patients (16-20).

It has been determined in the study of Cooper et al. (21) that the expenditures made in the ICU constitute 25–40% of all hospital expenses. The development of pressure ulcers is one of the major causes of an increase in length of stay in the ICU, patient morbidity/mortality, and costs (7, 8). The rates of pressure ulcers in the ICU take an important place in indicator applications that the Ministry of Health follows routinely nowadays for the purpose of primarily patient safety, clinical effectiveness, the standardization of monitoring/treatment, and for reducing the expenditure (22).

From this point of view, pressure ulcer risk assessment is one of the evaluations that falls under the remit of patient safety. What is required to be done when the patient is admitted to the service is to provide for the planning, follow-up, and continuity of the care in whom a pressure ulcer risk assessment will be made. Risk assessment scales that are reliable, valid, and that completely reveal the situation of the patient are of great importance, in particular for increasing the quality of care of the patient and for creating care standards (1-5, 23).

BRDs is the most widely used scale in practice and is said by some authors to be the most reliable and valid instrument that can be used in a wide age range of patients (8-14). The scale includes

Table 3. Comparison of patients with and without pressure ulcers

Patients characteristics		With pressure ulcers (n=41)	Without pressure ulcers (n=165)	p
Age (years)		71.08±18.7	63.8±20.4	0.043[2]*
Gender (n)	Male	23 (56.1%)	93 (56.36%)	0.824[2]
	Female	18 (43.9%)	72 (43.64%)	0.839[2]
Body mass index		22.6±2.96	21.4±3.11	0.756[1]
Duration of hospitalization (days)		25.14±9.87	13.24±6.73	0.002[1]*
State of consciousness (n)	Open	19 (14.28%)	114 (85.72%)	0.025[2]*
	Stupor-coma	22 (30.14%)	51 (69.86)	0.039[2]*
Apache II		17.65±7.2	16.23±8.1	0.303[1]
Expected mortality (%)		23.51±2.24	20.87±3.19	0.342[2]
Albumin (g/dL)		2.87±0.73	3.54±0.62	0.029[1]*
Braden score		13.6±3.1	13.1±3.7	0.367[1]
BRD	No risk	3 (7.14%)	39 (92.86%)	0.002[2]*
	Low risk	13 (27.08%)	35 (72.92%)	0.016[2]*
	Intermediate risk	11 (29.73%)	26 (70.27%)	0.017[2]*
	High risk	14 (17.72%)	65 (82.28%)	0.003[2]*
Prognosis (n	Discharged	19 (46.34%)	117 (70.9%)	0.017[2]*
	Died	22 (53.66%)	48 (29.1%)	0.021[2]*

Unpaired Student's t test; Chi-square test; * p<0.05 statistically significant difference; n: number; mean: arithmetic average; SD: deviation from the arithmetic mean; min: minimum value; max: maximum value; g: gram; dL: deciliter

six sub-parameters: the perception of stimulus: wetness, activity, movement, nutrition, and friction and irritation (Table 1) (9). However, some parameters that are reported as a risk factor by many authors are not included in this risk scale. In recent years, there has been an increase in the number of publications disclosing that this risk assessment scale is not as reliable as claimed (24-29).

Advanced age has an important place in the etiology of pressure ulcers, and it has been identified that the age increase of hospitalized patients is an important risk factor for the formation of pressure ulcers (15). In our study, the age of patients with pressure ulcers was found to be statistically significantly higher than those without it. This finding is consistent with the literature, and the decrease in skin turgor along with aging and the changes in the structure of collagen increase the risk of pressure ulcer development (15, 30-34). However, age is not evaluated in BRDs for pressure ulcers.

In our study, although the rate (56.1%) of male patients in the group in which pressure ulcers developed was found to be higher, a similar rate (56.36%) was observed in patients without pressure ulcers. No significant correlation between pressure ulcers and gender was shown and this result agrees with some other similar studies (35).

Obesity is said to be among the risk factors of pressure ulcer development by many writers (17, 36). We tried to minimize the impact of this variable by including patients with normal BMI in our study. In addition, there was no statistically significant difference in terms of BMI between the patients with and without pressure ulcers. However, it is remarkable that BRDs does not have an evaluation parameter in this regard, and we believe that this can negatively affect the risk score.

According to our findings, the prolongation of hospitalization increases the risk of pressure ulcer development. In our study, the duration of hospitalization in patients with pressure ulcers (25.14±9.87 days) was found to be statistically significantly longer compared to those without pressure ulcers (13.24±6.73 days). This result is consistent with the literature (37-39). However, the length of stay is not one of the parameters of BRDs.

The limitation of movement of the patients in intensive care units increases the risk of pressure ulcer development. One of the major causes of the limitation of movement is unconsciousness. Patients who remain unconscious for a long period of time continuously stay in the same position. Despite regular and frequent position changes in these patients, a significant risk continues of the development of pressure ulcers. In our study, while pressure ulcers developed in 14.28% of patients who were conscious and could be communicated with, this rate increased to 30.14% in patients who had confused consciousness or who could not be communicated with. This statistically significant difference was observed to be consistent with the findings in the literature. It is believed that immobility causes the distortion of the local blood flow in the tissue by a pressure effect and the perception of stimuli, such as pain, is prevented; thus, the patient is considered to be prevented from giving a self-protective response to

these stimuli (15, 23). BRDs bases the two (movement, activity) of six parameters on this medical truth and this is one of the positive aspects of the risk assessment system.

Another important reason for immobility is the sedative and analgesic drugs that are used. Sedative and analgesic drugs used in intensive care patients lead to an increase in pain threshold and a failure in cognitive functions, which facilitates the development of pressure ulcers (40). We minimized the negative impact of this variable by not including patients who should constantly use sedation/analgesia in our study group. However, there is not a direct parameter in BRDs that draws attention to this issue. Although we found that the Apache II score was higher in the group with pressure ulcers than the group without pressure ulcers in our study, no statistically significant differences emerged. Cox (31) showed in 2011 that the Apache II score could be significant in terms of the severity of the diseases and mortality projection but it was not a reliable empirical indicator for the development of pressure ulcers in the ICUs. Shahin et al. (41) determined the relationship between high Apache II values and the development of pressure ulcers in their study, but when a logistic regression test was applied, they concluded that Apache II was not significant as a risk factor. One of the most striking features in our study was that the actual mortality (53.66%) was much higher than the expected mortality (23.51%) in patients with pressure ulcers. We believe that the reason for this is that the infectious agent whose invasion has become facilitated participates in the clinical picture due to the termination of the protective barrier effect of the skin and this causes pathologies such as sepsis etc. that negatively affect the direct mortality.

The contribution of nutrition in the formation of pressure ulcers is unquestionable. Although we chose patients with an albumin over a specific value (2.5 mg/dL) for our study group, there as statistically significant differences between the blood albumin levels of those with pressure ulcers (2.87 mg/dL) and those without pressure ulcers (3.54 mg/dL). These findings are completely consistent with the literature (17, 18, 20, 33, 36, 41). Although there is a parameter about nutrition in BRDs, the assessment is open to interpretation and is based on some concrete mathematical parameters (albumin levels, daily caloric intake, BMI, etc.). Modification is needed in the scale in this regard as well.

The rate of pressure ulcer development was found to be 19.9% in our series of patients. Third-level ICU patients are known to be at high risk for the development of pressure ulcer. Stordeur et al. (42) found that pressure ulcers developed in 30% of patients in a study they conducted with 163 patients. The prevalence of pressure ulcers in patients was presented as between 28.6% and 36% in different studies conducted in intensive care units (10, 16, 18, 43). Although the group of patients we chose is in the group considered high risk in terms of the development of pressure ulcer, the results we obtained gave a favorable opinion for the evaluation of our intensive care services.

According to the data we obtained from BRDs, while pressure ulcers were found in 27.8% of low-risk patients and in 29.73% of intermediate-risk patients, pressure ulcer developed was only 17.72% in high-risk patients. It is clear that these data do not definitively indicate the risk. It is also remarkable that there is not a statistically significant difference in the scores of patients with and without pressure ulcers.

Though it is not in the scope of our survey, the localizations and stages of the pressure ulcers are consistent with other studies (6, 7, 10, 12, 14, 16-21).

The most important limitation of our study is that the time of emergence of the pressure ulcer was not recorded. The evaluation was only made in terms of "developed" or "didn't develop". However, because the purpose is to test the BRDs in third level ICU patients, it may not be evaluated as a major shortcoming. In addition, routine follow-up and treatment protocols of the patients, especially the ones related to pressure ulcers, were not mentioned because it was beyond the scope of the present work.

CONCLUSION

We have seen in the results of this study that a significant portion of intensive care patients are at high risk of the development of pressure ulcers. However, the fact that pressure ulcers developed only in about one-fifth of patients draws attention to the importance of patient care once again. Inactivity developing due to the decrease in the level of consciousness of the patient, a long hospitalization time, and malnutrition together with advanced age are seen as the most important risk factors in the development of pressure ulcers. The BRDs cover only part of these risk factors and is thus considered to be inadequate in the full risk assessment. Risk assessment scales that contain the other parameters and that are more suitable for the patients of our country are required, or the existing scales need serious modifications (29, 31, 44-49). Pressure ulcer development risk in patients treated in ICUs should be revised in coordination with healthcare workers. We need to ensure the correct preventive treatments for patients who are determined to be at risk in terms of the development of pressure ulcers according to the newly modified pressure ulcer assessment scales. These applications will reduce the cost of treatment while increasing the comfort of the patient.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Haseki Training and Research Hospital.

Informed Consent: Written informed consent was obtained from patients or patients' parents who participated in this study.

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