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Determination of Pressure Ulcer Incidence and Its Related Risk Factors at Orthopedic Wards: A Descriptive Study

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ABSTRACT

Pressure ulcer and its related factors are associated with complications such as decreased quality of life of patients and increased cost of health system as important issues of nursing care. This descriptive study was conducted to determine the incidence of pressure ulcer and its related factors in patients at orthopedic wards.
Methods: 330 patients with no pressure ulcer at the time of admission were selected through convenience sampling. A demographic questionnaire, European Pressure Ulcer Advisory Panel Grading System and Braden Pressure Ulcer Assessment Scale were used for data collection.
Results: 46 patients (%13.9) developed pressure ulcers of which %76.1, %21.7 and %2.2 were at stages one, two and three respectively. The most common locations of the ulcers were in sacrum (%34), ischium (%34.8), heels (%17.4) and both sacrum and heels (%10.9).
Conclusion: The incidence of pressure ulcers in our study is similar to other reports around the world. Risk factors in this regard are old age, lengthy hospitalization and medical diagnosis, type of therapy, low Body Mass Index score, decreased activity and immobility.
KEYWORDS: Pressure ulcer, Risk factors, Braden Pressure Ulcer Risk Assessment Scale.

INTRODUCTION

Pressure ulcers are one of the major challenges in clinical care.[1] Pressure ulcer is described as "an area of localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure or pressure in combination with shear and/or friction.[2] Development of pressure ulcers is associated with pain, depression, loss of function and independence, increased incidence of infection, sepsis and additional surgical procedures, all of which potentially result in a prolonged hospital stay.[3] The total annual cost of preventing and treating pressure ulcers has been estimated to be between 1.4-2.1 billion pounds in United Kingdom.[4]

The incidence of pressure ulcers has been reported in groups of both hospitals and community health care services to vary between 3% and 10%, in acute care services group, between 2.7% and 29%, in surgical patients, between 3.5% and 29.5%, in orthopedic procedures between 8.5 % and 35% and in major surgical procedures 13.7%. [5]The incidence of pressure ulcer is high, but even now little is known about the impact of pressure ulcer risk factors.[6] In the literature, the main groups at high risk for pressure ulcer development are: patients with spinal cord injuries, geriatric patients, and hospitalized patients, especially those who have had orthopedic surgery.[3]Increased understanding of factors related to the incidence of pressure ulcers can help to identify patients requiring timely initiation of treatment.[7] Training nurses regarding pressure ulcer utilizing nursing process can lead to pressure ulcer prevention.[4] There is no accurate information regarding the incidence of pressure ulcer and its treatment cost in Iran.[8] Due to the complex process of pressure ulcer development,[3] conducting research on pressure ulcers and its related factors is of particular importance. Therefore, the present study was conducted to determine the incidence of pressure ulcer and its related risk factors in hospitalized patients in the orthopedic wards in four hospitals in Tehran.

MATERIALS AND METHODS

Ethics

Permissions for data collection were obtained from research deputy of ShahidBeheshti College of nursing

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and midwifery and vice chancellor for education of ShahidBeheshti University of Medical Sciences. Then the approvals were obtained from the matrons and head nurses of the orthopedic wards of four hospitals affiliated to ShahidBeheshti University of Medical Sciences. Verbal informed consent was obtained before the commencement of the study. They were assured that there would be no penalties if they withdrew from the study at any time and that their rights of anonymity and confidentiality would be protected.

Instruments

In this descriptive study the data gathering tools were a demographic information questionnaire, Braden Pressure Ulcer Risk Assessment Scale and European Pressure Advisory Panel Grading System.

Demographic information questionnaire was designed by researchers and included items such as age, sex, medical diagnosis, body mass index, kind of treatment, smoking and length of hospitalization.

The Braden Pressure Ulcer Risk Assessment scale was used for determining the risk of pressure ulcer development in patients. The scale, developed in 1984, is one of the most used pressure ulcer risk assessment scales and have been shown to have good sensitivity (83% - 100%) and specificity (64%- 77%). In Braden Pressure Ulcer Risk Assessment Scale, each item is rated from 1 (least favorable) to 4 (most favorable) with the exception of friction and shear, which is rated from one to three. The total score (range 6-23) indicates the risk for pressure ulcer development, where lower scores represent higher risks.[9]

European Pressure Ulcer Advisory Panel Grading System for pressure ulcer containing four grades developed in 1999. In this grading system, a grade one pressure ulcer was defined as non-blanch able erythematous skin. Discoloration of skin, warmth, oedema, induration or hardness may also be used as indicators, especially in individuals with darker skins. A grade two pressure ulcer was defined as an area of partial-thickness skin loss involving the epidermis, dermis or both that presents as a blister, abrasion, or shallow crater. A grade three pressure ulcer was defined as full thickness skin loss involving damage or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia. A grade four pressure ulcer was defined as extensive destruction, tissue necrosis damage to muscle, bone, or supporting structures with or without full thickness skin loss.[10]

The authors translated and adapted the Braden Pressure Ulcer Risk Assessment Scale and European National Pressure Advisory Panel Grading System in to Persian and tested them for validity and reliability. The tools were validated by content validity index. To determine the reliability of Braden Pressure Ulcer Risk Assessment Scale and European National Pressure Advisory Panel Grading System inter-rater method was used. Braden Pressure Ulcer Risk Assessment Scale and European National Pressure Advisory Panel Grading System were tested in 20 patients in the same terms by the researcher and a nurse with a Bachelor's Degree who worked in a hospital affiliated to ShahidBeheshti University of Medical Science. Agreement of two observers were calculated by intra-class correlation coefficient and were 0.95 (Braden Pressure Ulcer Risk Assessment Scale) and 0.88 (European National Pressure Ulcer Advisory Panel Grading System).

The Body Mass Index data form contains two questions for determining the patient' height and weight.[5] The BMI was calculated using this formula:

BMI= weight (kg)/ height (m)^2. The results were categorized as this:

<20= thin, 20-24.9= normal, 25-29.9= moderately overweight, >30= obese.

Clinical setting

This study was performed at orthopedic wards of four hospitals (Akhtar, Loghman, Taleghani, Imam Hossein) affiliated to ShahidBeheshti University of Medical Sciences in Tehran between2009-2010. Patients who were 18 years of age or older with no pressure ulcer at the time of admission, no movement due to therapeutic interventions or movement only with assisting devices were selected through convenience sampling. Data collection lasted approximately three calendar months. Entering the orthopedic ward, from the list of admitted patients, patients who were admitted on the same day and had not pressure sores were selected. Demographic data of the patients were completed and each patient was inspected daily in the morning shift on the scale of Braden Pressure Ulcer Risk Assessment Scale and European Pressure Advisory Panel Grading System for determining presence or absence of pressure ulcer and its related risk factors by researcher from admission until discharge. Those who developed pressure ulcer were considered in calculation of incidence. All the data was gathered by one researcher.

Statistical analysis

The sample size was determined using this statistical formula:

$$N = \left[A + \sqrt{A^2 + \frac{n}{P}}\right]^2$$

Where n is the minimum required sample, P is the percent of individuals who meet the inclusion criteria and A is calculated by the following formula:

$$A = \left|\frac{Z_{\propto}}{2}\right| \times \sqrt{\frac{1-P}{P}}$$

Using this statistical formula the required sample size was 279 patients.[11] Researchers succeeded to consider 330 patients in data collection process. The statistical software package SPSS for Windows version 15 was used for statistical analysis. Results were expressed in percentages. Data analysis and comparison of data between the patients who developed and did not developed pressure ulcer were performed by x^2, Fisher's Exact test, independent samples t-test, Logistic Regression model.

RESULTS

In this longitudinal descriptive study 330 patients were considered. Findings show that 74.8% of the cases were men and 25.2% were women. The highest percentage of the subjects (56.1%) was between the ages of 18-35 years old and the mean and standard deviation of the subjects` age were 39.52 and 19.20 respectively. Most of the subjects (40.3%) were hospitalized between 7 to 14 days. The mean and standard deviation of the hospitalization duration were 10.04 and 6.34 respectively. Most of the patients (72.7%) were non-smokers. Most of the subjects (54.2%) had normal Body Mass Index. The majority of the patients (64.8%) had the fracture of bones and the lowest percent (1.2%) were hospitalized with diagnosis of tumor. Most of the patients (94.2%) underwent surgery. Patients' characteristic for those developing pressure ulcers and non pressure ulcer patients is given in table 1.

Table 1: Patients` characteristic for those developing pressure ulcers and non pressure ulcer patients

Characteristics	Had pressure ulcer	Had not pressure ulcer	P Value
Age (years)	56.44±12	37.45±15.1	<0.05
BMI	20.10±4.5	21.51±3.3	<0.05
Length of hospitalization	17.92±3.2	9.32±4.5	<0.05
Kind of treatment(having surgery)	80	20	<0.05
Medical diagnosis(having bone fracture)	91	0.9	<0.05

Results are presented as mean ± SD and comparisons are calculated by t- test. Kind of treatment and medical diagnosis are presented by percent and their comparisons are calculated by chi-squared test.

13.9% of the patients developed pressure ulcers in research period of which %76.1, %21.7 and %2.2 were at stages one, two and three respectively. Most of the patients (84.8%) developed one pressure ulcer, 13% in two regions and 2.2% in three regions. The most common locations of the ulcers were in sacrum (%34), ischium (%34.8), heels (%17.4) and both sacrum and heels (%10.9).

The largest proportion of the patients who developed pressure ulcer (44.4%) aged between 69-86 years old. There was a significant statistical relationship between age and developing pressure ulcer using chi-square test (x^2=68.15, DF= 5, p=0.00). The highest percent of the patients who were hospitalized between 28-35 days developed pressure ulcer (66.7%). There was a strong statistical relationship between hospitalization days and developing pressure ulcer using chi-square test (x^2=68.15, DF =5, p=0.00). In present study, pressure ulcer incidence was higher in underweight patients (BMI<18.5). A majority of patients (61.1%) with BMI score lower than 18.5 developed pressure ulcers. There was a strong relationship between low BMI score and pressure ulcer development (X^2= 83.34, DF= 3, p<0.05). The largest proportion (19.6%) of the patients with bone fracture diagnosis developed pressure ulcer. Using Fisher`s Exact test there was a significant relationship between medical diagnosis and developing pressure ulcer(f=18.27, p=0.003). The highest percent of the patients (14.8%) who munder went surgery developed pressure ulcer. Using Fisher`s Exact test there was a significant relationship between medical treatment and developing pressure ulcer (f=3.26, p=0.003). The majority of the patients (72.7%) were non smokers. Using X^2 statistical test there was not any significant relationship between smoking and developing pressure ulcer in this study (X^2=0.026, DF= 1, p= 0.87).

The largest proportion of the patients (75.6%) with activity average score of 2.69 developed pressure ulcer. Using chi-square test there was a significant relationship between activity item in Braden Pressure Ulcer Risk Assessment Scale and developing pressure ulcer (x^2=151.08, DF=2, p=0.00). The majority of the patients (58.4%) whose mobility average score were 2.76 developed pressure ulcer. Using chi-squared test there was a significant relationship between mobility item in Braden Pressure Ulcer Risk Assessment Scale and developing pressure ulcer (x^2=165.86, DF=3, p=0.00).

Finally, relative factors were entered in Logistic Regression Model. In this model age, body mass index, duration of

hospitalization, medical diagnosis, kind of treatment had significant impact on the dependent variable (pressure ulcer development) and other independent demographic variables (such as patient sex and smoking) had no significant effect. Results of the related demographic variables on pressure ulcer development using Logistic Regression Model are given in table 2.

Table 2: Results of the related demographic variables on pressure ulcer development using Logistic Regression Model

Variables	Variable Coefficient	Degree of Freedom	P Value	Odd Ratio	95% Confidence Interval for Odd Ratio	
					Lower	Upper
Age	13.36	1	P<0.01	0.958	0.93	0.98
BMI	12.48	1	P<0.01	1.30	1.13	1.50
Length of hospitalization	24.90	1	P<0.01	0.830	0.78	0.89
Kind of treatment	7.5 4	1	P<0.01	3.31	1.40	7.79
Medical diagnosis	7.19	1	P<0.01	1.40	1.09	1.80

Body mass index, length of hospitalization, medical diagnosis, kind of treatment had a significant impact on pressure ulcer development.

Braden Pressure Ulcer Risk Assessment Scale related variables were entered in Logistic Regression Model and following results were obtained. Activity and mobility had a significant impact on the development of pressure ulcer and other independent variable (such as sensory perception, moisture, nutrition, friction and shear) had no significant effect. Results of Braden Pressure Ulcer Risk Assessment Scale related variables on pressure ulcer development using Logistic Regression Model are given in table 3.

Table 3: Results of Braden Pressure Ulcer Risk Assessment Scale related variables on pressure ulcer development using Logistic Regression Model

Variables	Variable Coefficient	Degree of Freedom	P Value	Odd Ratio	95% Confidence Interval for Odd Ratio	
					Lower	Upper
Activity	34.93	1	P<0.01	19.96	7.39	53.89
Mobility	4.76	1	P<0.01	6.05	1.20	30.52

Activity and mobility were the two significant risk factors of pressure ulcer.

DISCUSSION

This research investigated the pressure ulcer incidence rate in four university hospital setting in Tehran as well as patient characteristics. Incidence rate which is described as the number of new cases per population in a given time period conveys information about the risk of contracting the disease. Incidence rate is usually more useful than prevalence in understanding the disease etiology, so researchers focus on the incidence rate of pressure ulcers in this study.[12] The patients developed a total of 46 (13.9%) pressure ulcers. Therefore, the incidence rate for patients developing pressure ulcer was 13.9%, which is similar to previously published incidence rates among other patient populations in clinical settings.[5] The incidence rate of pressure ulcer in hospitalized patients in United States of America has been reported 1.5-10.27%.[13] Incidence rate vary from one study to another because of different criteria for determining of pressure ulcer.[14]

39 patients (84.8%) had single pressure ulcer and 7 cases (15.2%) had multiple pressure ulcers. In this research stage one and two pressure ulcers comprised 97.8% of the ulcers. No patient developed stage four pressure ulcer. The low number of stage three pressure ulcers (2.2%) may be related to the attentive nursing cares that prevent further ulceration. Pressure ulcer locations most frequently observed were in the sacrum, ischium, heels and both sacrum and heels. Several factors determine the locations of pressure ulcers including lying position and time spent in bed. Patients lying in a supine position are more likely to develop pressure ulcers on the sacrum, heels, back and even occipital area which are consistent with the research results.[5]

The results showed that older patients were more susceptible to develop pressure ulcer. The mean age of patients developed pressure ulcer was 56.44 years. This result corresponds with the reported results of other researchers.[3, 4] Research on the elderly has shown that elderly have wrinkled skin and are prone to pressure ulcers due to loss of subcutaneous adipose tissue.[9] In one study 66% of the elderly who were hospitalized for orthopedic surgery were susceptible to develop pressure ulcer.[15] In the elderly, the accumulated effects of impairment due to aging, chronic co-morbidities and their primarily disease predispose old patients to develop

pressure ulcer.[16]

Also the results indicated that duration of hospitalization had significant relationship with pressure ulcer development. As duration of hospitalization increased, the percentage of the patients with pressure ulcer increased. These results are in agreement with previously published results.[17] but these results are different with results of a study in which duration of hospitalization is not involved in the developing pressure ulcer. Probably this contradiction is due to the short duration of hospitalization in their study.[6] Due to the patient`s condition and treatment measures, patient is hospitalized for a long term and that leads to pressure ulcer development.[17] In this research the majority of patients with low Body Mass Index (61.1%) developed pressure ulcer. The findings showed that there is strong relationship between Body Mass Index and developing pressure ulcer. Poor nutrition can lead to muscle wasting or reduction of overall body mass and Body Mass Index. Because this issue impacts on the elasticity of the skin, it can result in loose skin folds, making the skin less resilient.[9]This result is consistent with the literature in which underweight patients due to low muscle mass are more prone to develop pressure ulcer.[7]

In this study there were no statistically significant differences with regard to pressure ulcer development between smokers and non smokers. This result is consistent with other studies in which there were not any significant differences with regard to pressure ulcer development between smokers and non-smokers.[17] This may be due to a majority of non-smokers in the study. As expected, pressure ulcer development was higher in patients with specific medical diagnosis. 20% of the patients with bone fractures developed pressure ulcers whereas 0% of the patients with infection diagnosis did not developed pressure ulcer. So, having a medical diagnosis of bone fracture had a significant relationship in developing pressure ulcer in this research. This could be as a result of long duration of hospitalization of patients with bone fracture and immobility which these patients experienced during hospitalization. This finding agrees with previously published studies in which patients with hip fractures constitute a group of patients with pressure ulcer. The patients who had bone fracture were more prone to pressure ulcers than the patients who were hospitalized for other reasons such as infection.[18] As results showed, there were no statistically great differences with regard to pressure ulcer development between men and women. This result is consistent with other studies in literature which gender was not associated with pressure ulcer development among medical patients.[17] Another risk factor in this study was undergoing surgery. Patients who did not undergo surgery during hospitalization did not developed pressure ulcer (19%) whereas the patients who had a surgery during hospitalization were more susceptible to develop pressure ulcer (14.8%). This result confirms results of previous studies which said that fasting before and after the surgery decreases the level of blood nutrients and besides, immobility of the patient during surgery procedure (preoperative and postoperative) will increase the risk of developing pressure ulcer.[5,16]

In this study among the six items of Braden Pressure Ulcer Risk Assessment Scale, two items (activity and mobility) had significant impact on development of pressure ulcer.

A reduced level of activity is an important pressure ulcer risk factor in this study. The association between pressure ulcer development and activity is in accordance with other observations in other studies. Low level of activities in hospitalized patients with regard to older age and other co-morbidities and physical restraints leads to muscle mass and skin layers wasting and leading ultimately to tissue necrosis.[4, 9]

In this research there was a significant relationship between immobility and pressure ulcer development. This result is similar to other published studies.[4, 17] Patients who are confined to bed are more susceptible to pressure ulcer development. A lot of changes occur during immobility and bed rest, which is presumed to contribute to the development of pressure ulcers.[16]In simple terms, prolonged pressure at levels greater than capillary closing pressure will ultimately result in tissue necrosis. When considering pressure as the force over a body area, particularly a bony prominence, the important factor to consider is the degree of pressure and the length of time that the pressure is exerted. Prolonged low levels of pressure could be as damaging as shorter periods of high pressure. However, the impact of tissue tolerance to loading pressure can vary with the individual, when comparing the impact of long period loading on the tissue viability of healthy volunteers with volunteers with spinal-cord injury. [9]

Conclusion

This research determined pressure ulcer incidence rate and its most related risk factors among patients hospitalized at orthopedic wards. Data published by the Agency for Health Policy Research show that the prevalence of pressure ulcers in hospitals varies from 4% to 69% and the incidence rate in hospital setting from 3% to 30%. So, the incidence of pressure ulcer in this research is similar to other studies around the world. Risk factors in this regard are old age, lengthy hospitalization, low BMI scores, medical diagnosis, type of therapy, decreased activity and immobility.

Determining pressure ulcer incidence rate and its related risk factors may increase the accuracy of our early treatments and allocation of services. It should be highlighted that assessments of pressure ulcer risk factors is only a first step to prevent pressure ulcer. Experienced researchers and clinicians should use these results to develop pressure ulcer prevention protocols. Pressure ulcer prevention education for clinicians should be ongoing and frequent with emphasize on the importance of skin daily checks to implement pressure ulcer prevention interventions. After utilizing pressure ulcer prevention protocols, the further incidence researches will help us to determine the effectiveness of these interventions.

Ethical issues

None to be declared.

Conflicts of interests

The authors declare no conflicts of interest.

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