

Effect of Skin Care and Bony Prominence Protectors on Pressure Ulcers among Hospitalized Bedridden Patients

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Abstract Background: Pressure ulcers represent a common health problem among the immobilized patients that prolong their period of hospitalization. The skin care, reduction of pressure on the bone prominence areas, and mobilizing the bedridden patients can provide a significant difference in pressure ulcer development. **Aim of the study was** to evaluate the effect of skin care and bony prominence protectors on pressure ulcers among the hospitalized bedridden patients. A quasi-experimental **research design** was adopted. **Setting:** The study was carried out at the orthopedic and ICUs of Menoufia university hospital, Menoufia governorate, Egypt. **Subjects:** A total of 282 patients were recruited. **Tools:** Five tools were used included the structured questionnaire, Braden Scale for Predicting Pressure Sore Risk, Pressure Ulcer Scale for Healing, Katz Index of Independence in activities of daily living, and Glasgow Coma Scale. **Results:** The mean age for the patients was 48.7 ± 13.3 years old. Three quarters of the sample were adult and 25.5% was elderly patients with mean age 64.97 ± 5.21 years old. 96.2% of the adult patients and all the elderly patients had a high risk for bedsores. The reported causes for pressure ulcers were the increased level of dependence due to immobility, uncontrolled chronic diseases, urinary and fecal incontinence, anti-inflammatory and corticosteroid medications, obesity, edema, anemia and dementia. There was a reduction of pressure ulcer risk with a statistically significant difference between the pre and post-test for the Braden score and pressure ulcer healing score ($P < 0.001^{**}$). **Conclusion:** Skin care and bony prominence protectors can reduce the risk for pressure ulcers. **Recommendations:** The nurses should encourage the patient's mobility, assess the skin regularly, and provide skin care especially in the scapula, elbows and buttocks for the ICU patients and focused the skin care in the knee, heel, buttocks and toes for the orthopedic patients.

Keywords: skin care, bony prominence protectors, pressure ulcers, bedridden patients

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1. Introduction

Pressure ulcer is a localized damage to the skin or underlying tissue over a bony prominence resulting from sustained pressure [1,2]. It can range from mild reddening of the skin to severe tissue damage and infection extends into the muscles and bone [3]. The damage can exist as intact skin or an open ulcer [1] produced by pressure exerted upon over a bony prominence [4]. Areas of the body that commonly predisposed to pressure ulcers included the shoulders, back of the head, elbows, hip, thighs, knees, heels and toes [5].

Pressure ulcer represents a public health problem which causes a high mortality rate [6] among the affected patients. It was one of the healthcare injury groups that prolong the period of hospitalization, constituting 20% of the total cost for healthcare injuries [7]. It can result in extensive patient harm including pain, expensive treatments and increased length of institutional stay. It can

cause premature mortality in some patients [8], physical and emotional problems which influence morbidity and have a negative social and psychological impact on the individual and their career [9]. Pressure injury can cause pain, the need for additional nursing interventions and damage to the patient sense of self confidence, leading to depression or social isolation due to wound symptoms such as odors. The drive to avoid harm is at the forefront of the argument for the investment of time and money in pressure ulcer prevention [10,11].

The actual prevalence of bedsores among the bedridden patients is difficult to be determined because the epidemiological studies differ in their methodologies which lead to a large variation in the incidence rate and prevalence of pressure ulcers. However, international studies have an incidence ranging from 4.5% to 25.2% in United Kingdom, and the reported prevalence of 2.9% to 8.34% in Spain, 14.8% in England and 19.1% in USA [12,13]. Also, more than six million patients each year suffered from bedsores in intensive care units, which cost 2.17 billion dollars [14]. Nearly 700,000 people in the UK

are affected by pressure ulcers each year across all care settings, including people in their own homes [15,16]. As regards to Brazil, there was a studies showed that 41.2% to 59.0% risk for the development of pressure injury and a prevalence between 8% and 23%. This is a cause for concern as it is something which can be prevented in up to 95.0% of the cases [17,18].

Generally, people with a medical complaint that limits their ability to change positions, those who spend most of their time in a bed [19], surgical patients [20] and patients who have a broken hip or undergone hip surgery are most at risk for bedsores [21]. Bed sore is more common to occur among immobilized patients especially elderly persons as a result of age related change in the different systems [22]. So, the pressure ulcers can occur depending on the patient mobility level and severity of the illness. There is a great risk for multiple comorbid conditions, immobility, hemodynamic instability and increased use of medical devices that increased the risk for bedsores among the critically ill patients [23].

From the previous studies it was known that the risk factors for pressure ulcer in community settings, hospitals and nursing facilities include the increased age, peripheral vascular diseases, shear, friction, impaired mobility, poor posture or deformity, underlying medical conditions, impaired nutrition and hydration, previous pressure damage, incontinence [24], multiple chronic diseases and tissue ischemia [25] with special attention for patients with conditions that lead to prolonged bed rest [26]. Added to that, male gender, additional linen layers, and longer lengths of stay cause development of pressure ulcer [27]. Moreover, the sedative, analgesic and muscle relaxant medicine, blackout, metabolic problems, circulatory abnormalities, mechanic ventilation, and dialysis are other causes [23]. The bedsores can be prevented among the previously mentioned high risk patients by providing the appropriate nursing care.

There are many methods of management for the problem depending on the category and severity of the ulcer. A conservative, nonsurgical approach may be appropriate for the first and second categories [28]. Other researchers focused on the design of the bed [29] and they designed a smart care bed which provides a real time pressure sensing algorithm that is capable of determining on the possibilities of bedsores by considering the intensity and the duration of pressure of specific body parts. Also, Meaume and Marty [30] suggested the use of an alternating pressure mattress overlay in patients lying for about twenty hours a day. But, the evidence on the effectiveness of these devices in decubitus ulcer prevention is limited [31]. On the other hand, training of the caregivers about prevention of pressure injuries among the bedridden patients was effective in reducing the risk for this problem [32]. The nurse is the formal caregiver who provides most of the care to the patient during the period of hospitalization. The researchers recommended that, efficient nursing care, proper assessment and timely interventions help the patient to recuperate from pressure ulcers [33].

Pressure injuries can result in severe harm or even death and research suggests that between eighty to ninety five percent are avoidable [34]. Of course, prevention has been a primary goal of pressure ulcer research [35]. It is a

vital part of nursing practice as all nurses are at the forefront of predicting the patients at risk, subsequent to which the nurses provide measures to the patient for healing of pressure injury [33]. All bedridden patients need special care and need to be properly educated regarding prevention of pressure sores and routine self-examination for development of new pressure sores [36]. So, the best preventive interventions focus on skin care, patient positioning, nutrition and education [37]. Likewise, olive oil moisturizing the skin and maintain elasticity [38]. Ayoub and Mohamed [22] stated that, using of olive oil should be one of the routine nursing cares for patient to prevent occurrence of bedsores. Nevertheless with these great efforts the number of patients suffered from bedsores still high especially among elderly patients due to skin changes, chronic illness and increased level of dependence. Also, this may be due to the nurses heavy work load, inadequate staff members (83.3%), shortage of resources (67.6%) and inadequate training about pressure ulcer prevention [39]. Therefore, the skin care, reduction of pressure on the bone prominence areas, and mobilizing for all bedridden patients can provide a significant difference in pressure ulcer development.

1.1. Significance of the Study

Pressure ulcers remain a common problem in hospitals and the community [35]. It concerns any patient, regardless of age or gender [26] but, it is more common among immobilized patients especially the elderly persons as a result of age related change in the different body systems [22]. In the recent years, there has been considerable effort to decrease the number of pressure ulcers and related harm [1]. The role of nurses is vital in preventing and managing this problem [33] by using pillows to help the individual stay in the correct position, switching positions, and applying moisturizing cream to the body daily [40]. Hence, prevention is a priority in nursing practice. It can reduce the immobilized adult and elderly patients suffering, complications, and duration of hospitalization. So, the medical surgical and geriatric nurses can prevent and control the bedsores among orthopedic and ICU patients through skin care, protection of bone prominence areas by using small pillows and frequently changing the patient position. They should be alert and able to recognize the early changes that occur prior to skin breakdown and provide the appropriate nursing care.

1.2. Aim of the Study

The study aimed to evaluate the effect of skin care and bony prominence protectors on pressure ulcers among the hospitalized bedridden patients.

1.3. Research Hypothesis

1. Skin care and bony prominence protectors will reduce the risk for pressure ulcers among bedridden patients.
2. There will be a significant difference between the pre and post-test for the Braden scale score and pressure ulcer healing scale score.

2. Subjects and Method

2.1. Research Design

To achieve the aim of the current study a quasi-experimental research design with pre-posttest was used to evaluate the effect of skin care and bony prominence protectors on pressure ulcers among the bedridden patients.

2.2. Study Setting

The current study was conducted at the orthopedic department and intensive care units of Menoufia university hospital at Shebin El-Kom district, Menoufia governorate, Egypt.

2.3. Sample

A convenience sample of 282 patients was recruited. The researchers selected the patients who fulfilling the following inclusion criteria: Adult and elderly patients, both sexes, bedridden more than 3 days and suffered from stage one or stage two pressure ulcers.

2.4. Calculation of the Sample Size

In order to calculate the required sample size, the researchers used the online creative research systems sample size calculator website. It has been searched, reviewed and checked for the calculated results based on known formulas for common research objectives [41]. The sample size has been determined based on the daily numbers of admission into the orthopedic department and intensive care units of Menoufia university hospital at Shebin El-Kom district. The flow rate of the target population with these specific inclusion criteria was 1055 patients per year. With a 95% level of confidence (error=5 %) and a study power of 95% the required sample size was equal 282 patients.

3. Tools for Data Collection

Five tools were used to collect the data from the patients included the following:

I. Structured questionnaire: It was designed by the researchers based on review of the related literatures. It included three parts:

Part 1:- Socio-Demographic characteristics such as age, sex, marital status, educational level, occupation, income and residence.

Part 2:-Medical history: This included questions about the patient's complaints, past and present medical histories.

Part 3:-Bio-physiological measurements: This included blood pressure, pulse, weight, height and body mass index (BMI). The BMI is estimated by dividing weight in kilogram divided by squared height in meters [BMI = weight (kg)/height (m)²]. A BMI of less than 18.5 is underweight, a BMI from 18.50 - 24.99 is normal while a BMI from 25 - 29.9 considered overweight and ≥ 30 is considered obese [42].

2-Braden Scale for Predicting Pressure Sore Risk: It was developed by Braden and Bergstrom (1989) to foster

early identification of patients at risk for forming pressure sores. The scale is composed of six subscales reflect the sensory perception, skin moisture, activity, mobility, friction and shear, and nutritional status. The patients with a total score of 16 or less are considered to be at risk of developing pressure ulcers. 15 or 16 = mild risk. 13 or 14 = moderate risk. 12 or less = high risk. A lower Braden scale score indicates a lower level of functioning and, therefore, a higher level of risk for pressure ulcer development [43].

3-Pressure Ulcer Scale for Healing: This scale was developed by National Pressure Ulcer Advisory Panel (NPUAP), (1998) [44]. PUSH tool version 3.0. 1998 to assess the healing processes of the ulcer at weekly intervals for the surface area (length by width), the amount of exudates and the type of wound tissue was determined and combined to obtain a total score from 0 (completely healed) to 17 (greatest severity).

4-Katz Index of Independence in activities of daily living (ADLs): It was developed by Katz et al., (1970). Clinicians typically use the tool to detect problems in performing ADLs and to plan care accordingly. The index ranks adequacy of performance in the 6 functions of bathing, dressing, toileting, transferring, continence and feeding. Patients are scored yes or no for independence in each of the six functions. A score of 6 indicates full function, 4 indicate moderate impairment, and 2 or less indicates severe functional impairment [45].

5-Glasgow Coma Scale (GCS): The scale was developed by Teasdale and Jennett, (1974) [46]. It is an integral part of assessing the levels of consciousness. The principle of assessing an individual's level of consciousness is about determining the degree of stimulation that is required to elicit a response from them, based on three modes of behavior: eye opening, verbal response and motor response. The findings in each response are described in clear terms, aimed at minimizing ambiguity. Each step in the eye, verbal and motor subscales was assigned a number the worse the response, the lower the number. The three responses measured are motor response maximum score of 6, verbal response maximum score of 5 and eye opening maximum score of 4. The lowest score for each category is 1, therefore the lowest total score is 3. A GCS of 8 or less considered as unconscious, from 9-12 GCS score is considered as semiconscious and conscious if GCS total score ranged from 13-15 [46,47].

Validity and reliability of the tools: The tools were developed by the researchers after a review of the related literature and tested for its content validity. Validity indicated the degree to which the tool measures what it was expected to measure, therefore in this study, the questionnaire content validity was determined by a panel of three experts in the field of medical surgical and geriatric nursing to test the content validity. Changes were carried out according to their judgment on the clarity of the sentences and relevance of the content. Reliability was assessed by applying the questionnaire to ten clients using test-retest. Also, the Braden scale has highly satisfactory reliability ($r = 0.99$).

Pilot study: A total of ten percent of the sample was included as a pilot study in order to assess the feasibility and clarity of the tools and determine the needed time to

answer the questions. It carried out prior to data collection. Based on its results, the changes were carried out and the average length of time needed to complete the tools was determined.

Fieldwork

- The official letter from Faculty of Nursing in Shebin Elkom, Menoufia University was prepared and delivered to undersecretary of the Shebin El-Kom university hospital director for the approval for data collection. Before conducting the study, permission was obtained. Then, the study purpose and schedule of data were clarified.
- The researchers were constructed and prepared the different data collection tools, designed the plan for nursing care and seeking the managerial arrangements.
- Data collection for this study was carried out over a period of 7 months starting from the beginning of January 2019 to the end of June 2019 in the orthopedic ward and ICUs. After that, data collection was carried out through three phases: assessment, implementation and evaluation phase.

Assessment phase:

The aim of this phase is to collect a baseline assessment of the data for bedridden patients using the first tool. Initially, clinical and demographic data were collected. Patients were assessed for risk of bedsores by the researchers using the second tool, activities of daily living were assessed by the fourth tool to assess the level of dependence and the level of consciousness was assessed by tool five.

Planning phase: The researchers go through extensive literature to design the plan for the interventions and preparing the bony prominence protectors (pillows with the size of 25 x 40 cm) that the researchers will use for the bony prominence areas. It was made of 100% cotton materials covered with cotton sheet. Individualized plan for the patients was developed based on the finding of the assessment. The goals, priority of care and expected outcomes criteria was formulated and taken first into considerations.

Implementation phase: The obtained information used as the baseline assessment (pre-test), then the researchers identify the patients at risk for developing bedsores by using the second tool through assessing sensory perception, moisture, activity, mobility, nutrition and friction and shear firstly and every week along three weeks. The researchers used the ulcer healing chart to identify the length and width of the ulcer by using sterile gauze and spread it on the length of the ulcer then spread the gauze on sterile metal ruler to measure the length and spread sterile gauze on width of ulcer then measuring the gauze by the sterile metal ruler, this done every week along three weeks to follow the ulcer healing. The exudation of sores was observed for amount, color and odor weekly for three weeks to evaluate the healing process of bedsores.

The nursing care included assessing skin and pressure points frequently and reposition schedule. Provide the repositioning techniques through using of 30 degree tilted side lying position alternately, right, back and left side, or 90-degree side lying. In addition, the researchers used the prepared pillows under the bony prominence areas to

decrease weight bearing from the body on these areas and provide good ventilation and dryness of the skin. The ulcer dressing using the aseptic technique by preparing the needed equipment and wear the sterile gloves to clean the ulcer wound by normal saline. Then good dry by sterile dressing and clean the ulcer with betadine. Mild dryness and apply antibiotic as prescribed and cover the wound with sterile dressing.

- **Evaluation phase "Post-test":** In this phase, patients were evaluated for the level of risk, stage, and healing process of the decubitus ulcer. The evaluation was done for all patients using all tools except tool one weekly along three weeks. Then, the comparison between pre and post-test were done by using the appropriate statistical analysis.
- **Human rights and ethical considerations:** An official permission was taken from the authoritative personal in the hospital. The researchers selected the patients who met the inclusion criteria and informed them about the aim of the current study in order to obtain their acceptance to share in this study. Written consent was obtained from the conscious patients and from their caregivers for the unconscious patients. Confidentiality and anonymity of them were assured through coding the data.

4. Statistical Analysis

Data were coded and transformed into a specially designed format suitable for computer feeding. All entered data were verified for any errors. Data were analyzed using statistical package for social sciences (SPSS) version 20 windows and were presented in tables and graphs. Chi-square analysis was performed and repeated measures ANOVA, mean and standard deviations were computed. An alpha level of 0.05 was used to assess significant differences.

5. Results

The study sample included 282 patients from the orthopedic department and ICUs of Menoufia university hospital at Shebin El-Kom district, Menoufia governorate, Egypt. **Table 1** shows that the mean age for the studied patients was 48.7 ± 13.3 years old. Three quarters of the sample were adult and more than one quarter of them (25.5 %) was elderly patients with mean age 64.97 ± 5.21 years old. Also, the majority of them was from rural areas (97.5%), married (52.5%), illiterate (41.5%), and had a moderate income (74.1%).

Figure 1 illustrates that the risk for bedsores was high among most of the studied bedridden patients regardless of their age. More than ninety percent (96.2%) of the adult patients and all of the elderly patients (100 %) had a high risk for bedsores.

Figure 2 explains the reasons for hospitalization among the studied patients. More than two thirds of the patients were hospitalized due to musculoskeletal problems (37.9%) and coma (37.6%). The other causes of hospitalization were the renal failure (11.3%), respiratory disorders (9.6%) and cardiovascular disorders (2.8%).

The data in Table 2 indicates that, the most common stated chronic diseases among the studied patients included the hypertension (28.9%), diabetes (25.3%) and arthritis (16.3%). The uncontrolled chronic diseases increased the patient's level of dependence and increased the risk for bed sores. Also, the reported causes that increased the risk for pressure ulcer development among the hospitalized bedridden patients were the increased level of dependence (63.8 %) due to immobility with 22.84 ± 2.1 mean number of hours for bed duration and 12.6 ± 3.3 mean duration of hospitalization, uncontrolled chronic diseases which cause complications (67.4%), urinary (57.8%) and fecal (37.9%) incontinence due to disturbance in level of consciousness (16.3% unconscious, 31.2 % semiconscious), anti-inflammatory (76.2%) and systemic corticosteroid medications (67.4%), obesity (55.7%), edema (65.2%), anemia (48.9%) and dementia (44.0%).

Generally, the buttocks (29.4%), scapula (17.7%), heel (14.9%), and sacrum (14.5%) are the most body areas affected by pressure ulcers (Table 3). Added to that, the reported body areas affected by pressure ulcers development among the ICU patients were in the buttocks (38.3%), scapula (21.1%), sacrum (19.4%) and the elbow (12.0%). On the other hand, the orthopedic patients may have bedsores in the knee (27.1%), heel (26.2%), buttocks (15.0%), scapula (12.1%) and toes (10.3%). This indicated that the focus of skin care on the bony prominence areas will differ.

Table 4 illustrates that, there was an increase in the total mean score for Braden scale during the post-test (12.43 ± 2.1) than the pre-test (8.68 ± 2.1) which indicated the reduction of risk for pressure ulcer development among the studied bedridden patients with a statistically significant difference between the pre and post-test for the Braden scale score ($P < 0.001^{**}$).

Regarding to the pressure ulcer healing, Table 4 shows a reduction in the length by width of the ulcer from the pre-test (6.29 ± 2.7) compared with the post-test (0.41 ± 0.8) which indicated the reduction of the ulcer diameter and improvement in ulcer healing. In addition, more than two thirds (70.6%) of the sample had mild exudate (70.6%) during the pretest but this percent reduced to 4.6% during the post-test with statistically significant difference between the pre and post-test for pressure ulcer healing scale score ($P < 0.001^{**}$).

Table 1. Distribution of socio-demographic characteristics for the patients (N=282)

Socio-demographic Characteristics		N=282	
		No.	%
Age (In years):	Mean \pm SD	48.7 \pm 13.3	
	Age category:		
	18- 59	210 (74.5 %)	43.12 \pm 10.4
	60+	72 (25.5 %)	64.97 \pm 5.21
Sex:	Male	141	50.0
	Female	141	50.0
Residence:	Rural	275	97.5
	Urban	7	2.5
Marital status:	Single	36	12.8
	Married	148	52.5
	Widow	83	29.4
	Divorced	15	5.3
Level of education:	Illiterate	117	41.5
	Primary	44	15.6
	Secondary	86	30.5
	University	35	12.4
Income:	Easily enough	15	5.3
	Enough	209	74.1
	Not enough	58	20.6

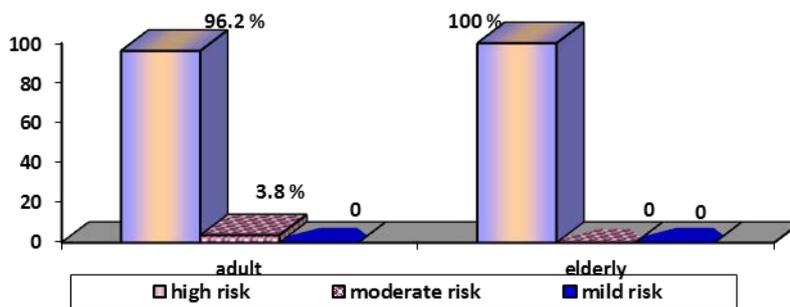


Figure 1. Distribution of the risk for bedsores according to the age categories of the patients

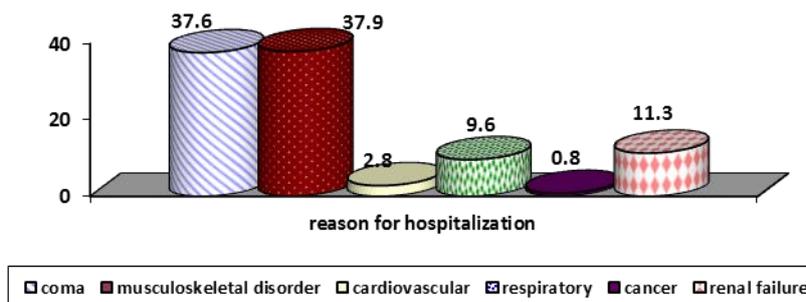


Figure 2. Distribution of the patients according to the reasons for hospitalization

Table 2. Distribution of the reported causes that increased the risk for pressure ulcer development

Risk factors	No.	%
Level of consciousness:		
Unconscious	46	16.3
Semiconscious	88	31.2
Conscious	148	52.5
Level of dependence:		
• Independent	7	2.5
• Partially dependent	95	33.7
• Completely dependent	180	63.8
Immobility: hours/day (Mean ± SD)	22.84 ± 2.1	
Duration of hospitalization Mean ± SD	12.6 ± 3.3	
Urinary incontinence	163	57.8
Fecal incontinence	107	37.9
Chronic diseases:	190 (67.4)	
Hypertension	55	28.9
Diabetes	48	25.3
Arthritis	31	16.3
Drugs:		
• Anti-inflammatory	215	76.2
• systemic corticosteroids	190	67.4
Obesity:		
Normal weight	7	2.5
Over weight	118	41.8
Obese	157	55.7
Anemia Hemoglobin (Mean ± SD)	11.13 ± 0.7	
Edema:	184	65.2
Lower extremities	105	57.1
Upper extremities	50	27.2
Generalized	29	15.8
Dementia	124	44.0

Table 3. Distribution of the studied patients according to the body areas affected by pressure ulcers

Area affected	ICUs	Orthopedic	Total	P value
Scapula	37 (21.1%)	13 (12.1%)	50 (17.7%)	$\chi^2=3.7$ $p<0.05^*$
Sacrum	34 (19.4%)	7 (6.5%)	41 (14.5%)	$\chi^2=8.9$ $p<0.05^*$
Buttocks	67(38.3%)	16 (15.0%)	83 (29.4%)	$\chi^2=17.4$ $p<0.001^{**}$
Trochanters	2 (1.1%)	2 (1.9%)	4 (1.4%)	$\chi^2=0.2$ $p>0.05$
Elbow	21 (12.0%)	7 (6.5%)	28 (9.9%)	$\chi^2=2.2$ $p>0.05$
Knee	3 (1.7%)	29 (27.1%)	32 (11.3%)	$\chi^2=24.5$ $p<0.001^{**}$
Heel	14 (8.0%)	28 (26.2%)	42 (14.9%)	$\chi^2=17.2$ $p<0.001^{**}$
Toes	4 (2.3%)	11 (10.3%)	15 (5.3%)	$\chi^2=8.4$ $p<0.05^*$

The result is significant at $p < .05^*$ and significant at $p < .001^{**}$.

Table 4. Mean and SD for Braden scale, pressure ulcer healing scale during pre and post-test

Variables	Pre-test	Post 1 week	Post 2 weeks	Post 3 weeks
Braden scale score	8.68 ± 2.1	8.95 ± 2.11	10.92 ± 1.9	12.43 ± 2.1
	$P < 0.001^{**}$			
Risk for bedsores:				
High risk	274 (97.2)	272 (96.5)	216 (76.6)	138 (48.9)
Moderate risk	8 (2.8)	10 (3.5)	64 (22.7)	92 (32.6)
Mild risk	0.0	0.0	2 (0.7)	52 (18.4)
	$P < 0.001^{**}$			
Pressure Ulcer Healing Scale score:				
Length × Width	6.29 ± 2.7	5.82 ± 2.4	2.37 ± 1.4	0.41 ± 0.8
	$P < 0.001^{**}$			
Exudate:				
No	1 (0.4)	1(0.4)	156(55.3)	269(95.4)
Mild	199(70.6)	214 (75.9)	122(43.3)	13(4.6)
Moderate	78(27.7)	66(23.4)	4(1.4)	0.0
Severe	4(1.4)	1(0.4)	0.0	0.0

The result is significant at $p < .05^*$ and significant at $p < .001^{**}$.

6. Discussion

Pressure ulcer is one of the most common problems among bedridden patients [48]. It can result in severe harm and research suggests that between eighty to ninety five percent are avoidable [34]. Correspondingly, the nurse can use pillows to help the individual stay in the correct position, switching positions, and applying a skin protectant to the body daily to reduce pressure to prone areas [40]. So, the current study aimed to evaluate the effect of skin care and bony prominence protectors on pressure ulcers among the hospitalized bedridden patients.

The present study results showed that three quarters of the studied bedridden patients were adult and more than one quarter of them were elderly patients. The risk for bedsores was high among most of the studied bedridden patients regardless of their age. More than ninety percent of the adult patients and all of the elderly patients had a high risk for bedsores. These results may be related to immobility which considered the main cause for the development of pressure injuries. This comes in accordance with Valimungighe et al., [26] who stated that pressure ulcers concern any patient regardless of age or gender. In contrast, Børsting et al., [49] mentioned that higher age was significantly associated with pressure ulcers.

There is no doubt that patients with sensory loss, impaired level of consciousness may not be aware of the discomfort associated with prolonged pressure on the skin and cannot change their position themselves to relieve the pressure [50]. Concerning the reasons for hospitalization among the studied patients, more than two thirds of the patients were hospitalized due to musculoskeletal problems and coma. Generally, bedridden patients [51] especially who are comatose, even with intact sensation

can develop pressure ulcer as they cannot communicate regarding the pain of increased pressure. This comes in accordance with Bhattacharya and Mishra, [52] who declared that the majority of persons affected with decubitus ulcer are those having health problems that can cause immobility specifically the patients who are confined to bed or chair for prolonged time. Several other health conditions that influence the blood supply and capillary perfusion such as type-2 diabetes can increase the vulnerability to pressure ulcers. Likewise, the most common stated chronic diseases among the studied patients for the present study included hypertension, diabetes and arthritis. The uncontrolled chronic diseases increased the patient's level of dependence and the risk for bed sores.

The other causes for hospitalization among the patients of the current study were a renal failure, respiratory disorders and cardiovascular disorders. Similarly Ayoub and Mohamed, [22] stated that musculoskeletal, neurological, cardiovascular, endocrine, urinary and respiratory disorders were presented respectively. Also O'Brien et al., [53] mentioned that the diagnosis of renal disease was associated with pressure ulcers. In fact, the prolonged pressure on the bony prominent areas for more than two hours can cause skin ulcerations.

Commonly, any health problem which causes stay in bed or a chair for a long time, have difficulty moving around, spend long periods in an armchair, have poor circulation, not eating a balanced diet or having enough to drink, have had a pressure ulcer before and under or overweight are risk factors for developing bedsores [54]. Regarding the main reported causes that increased the risk for pressure ulcer development among the studied hospitalized bedridden patients for the present study were the increased level of dependence due to immobility with more than twenty hours for bed duration and more than twelve days of hospitalization. The possible explanation for this might be due to the prolonged pressure on bony prominence which interfere circulation to the underlying skin which in turn decreases the skin resistance to pressure. It was known that immobility interfering with the delivery of oxygen and nutrients to tissues that affect skin integrity [55]. This comes on the same line with Ghali et al., [56] who reported the mean length of hospital stay was more than eight days. The most common medical histories were diabetes and high blood pressure. Moreover, the presence of chronic illness, use of medical devices, mobility and friction were found to be significant in binary logistic regression [57]. Another study by Ebrahim et al., [58] reported more than half of the patients stayed more than six days and about twenty percent stayed for more than three weeks. Among patients who had a hospital stay of more than twenty days after admission, twenty percent of them had developed an ulcer. But, it was rare among patients who had hospital stay of less than six days. Accordingly, limiting length of stay at hospital, practice of standardized and qualified nursing care as well as use of pressure relieving devices is needed.

Diabetes is associated with obesity. Morbid obesity is significantly associated with bedsores among the hospital patients [59]. Similarly, the current study presents diabetes, obesity and edema in the extremities as important factors contributing to the development of the pressure injury.

This result was in accordance with Aloweni et al., [20] who stated the age ≥ 75 years, female gender, body mass index < 23 , anemia, respiratory disease and hypertension as risk factors for pressure injury. Likewise Børsting et al., [49] mentioned that having diabetes associated with pressure ulcer but they reflected underweight significantly associated with pressure ulcers. Another research stated that cardiovascular diseases, musculoskeletal and respiratory disorders were observed in the study group. But, the body mass index of the two groups was within the normal range [60].

The present study revealed the urinary and fecal incontinence due to disturbance in level of consciousness, anti-inflammatory medications and systemic corticosteroids, edema, anemia and dementia as important factors contributed to the development of the pressure injury. Of course, urine and feces, malnutrition [51], low body mass index, anemia, low protein and albumin are predisposing factors as well as serious complications of pressure ulcers interfere with the cure [61]. In addition, moisture for a long period of time, completely limited activity [50], urinary and bowel incontinence [22] were thought to contribute to the development of pressure ulcers and can delay healing. Associations were found in bivariate analysis between development of pressure ulcer and age of respondents, change of position per day, presence of moisture as well as very poor nutritional status [58]. In the main, the buttocks, scapula, heel and sacrum are the most body areas affected by pressure ulcer. Added to that, the reported body areas affected by pressure ulcers development among the studied ICU patients were in the buttocks, scapula, sacrum and the elbow. On the other hand, the orthopedic patients may have bedsores in the knee, heel, buttocks, scapula and toes. This indicated that the focus of skin care on the bony prominence areas will differ. This comes in agreement with Valimungighe et al., [26] who declared that the sacral location was found in forty five percent of the patients, the gluteal location in thirty nine percent, trochanteric in thirty three percent and lumbar in two patients (6.1%). While other studies reported pressure ulcer was most frequently sited at the sacrum [57], sacrum and heel [49,51], heels and buttocks [56].

The use of Braden scale pressure ulcer risk assessment tool can be used to prevent the development of pressure ulcer as the tool is important to identify those at risk and not at risk and to prepare ahead to provide quality and appropriate care based on risk analysis and level of severity [62]. It is considered in the literature to be sufficiently reliable because of its sensitivity and specificity, to be used in routine practice to determine if a patient is "at risk" for developing a pressure sore or "not [63,64] The patients were categorized as having high and low risk of developing bedsores as per the Braden score of ≤ 9 and ≥ 10 , respectively [32].

The current study illustrated that there was an increase in the total mean score for Braden scale during the post-test than the pretest which indicated the reduction of risk for pressure ulcer development among the studied bedridden patients with statistically significant difference between the pre and post-test for the Braden scale score ($P < 0.001^{**}$). This finding is in consistent with Ghali et al., [56] who specified the mean Braden score

was fifteen and one in four patients had a very high risk of pressure ulcers.

At the last, the application of different nursing interventions resulted in a positive decrease in the incidence of pressure ulcers leading to either their prevention or at least decrease the risk of their development [60]. Also Reddy, Gill, and Rochon [65] stated that position change for bedridden patients is recommended after two to three hours. Additionally, the position of the patient need to be changed regularly, alternating between the back and sides, using a slide sheet and skin inspection for signs of possible or actual damage are important to prevent pressure injuries [54]. Regarding the pressure ulcer healing, the present study showed a reduction in the length multiply with a width of the ulcer from the pre-test compared with the post-test which indicated the reduction of the ulcer diameter and improvement in ulcer healing due to the implementation of the nursing interventions. In addition, more than two thirds of the sample had mild exudate during the pre-test but this percent reduced to only less than five percent during the post-test with a statistically significant difference between the pre and post-test for pressure ulcer healing scale score ($P < 0.001^{**}$). Similarly Hallaj, [60] reported mean score for pressure injury decreased among the study group after two weeks and the difference between the mean change in the two groups is statistically significant. The best interventions focused on skin care, patient positioning [37], using pillows to help the individual stay in the correct position and applying moisturizing cream to the body daily can help to alleviate pressure to prone areas [40]. Accordingly, considering the importance of skin care, use of bony prominence protectors, mobilizing interventions for all bedridden patients can provide a significant difference in pressure ulcer prevention and development.

7. Conclusion

Based on the findings of the present study, skin care and bony prominence protectors reduced the risk for pressure ulcers among the bedridden patients, improved the healing for pressure ulcers, and there was a significant difference between the pre and post-test for the Braden scale score and pressure ulcer healing scale score.

8. Recommendations

Based on the study findings the following recommendations are suggested:

1. Nurses should assess the patient's skin regularly for early detection of patients at risk for developing pressure ulcers.
2. Skin care and bony prominence protectors are important for pressure ulcer prevention and control.
3. The nurses should provide frequent skin care especially in the scapula, elbows and buttocks for the ICU patients. And, focused the skin care in the knee, heel, buttocks and toes for the orthopedic patients.

4. The nurses should encourage the patients and help them to change their position every two hours to reduce pressure, friction and shear damage on bony prominences.
5. Implementation of awareness programs for nurses and caregivers of immobilized adult and elderly patients regarding preventive measures for pressure ulcers.
6. The hospitals should maintain the necessary supplies required by the nurses to prevent pressure ulcers.
7. Further researches are needed with a large sample size to generalize the results.

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