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International Journal of Nursing

Peer Reviewed | Open Access | Free Online Journal | www.ijnonline.com

Published Biannually | ISSN: 2279-0195.



The Effect of Air mattresses (Total Care P 500®) on Pressure Ulcer Prevalence and Incidence Rates among Adult Post Cardiac Surgical Patients

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ABSTRACT

Background: Pressure ulcer development is a common problem worldwide, especially among patients in Intensive Care Units who are at higher risk of skin injury due to several factors such as limited mobility, inadequate skin moisture, illness, and poor nutritional status

Methods: Quantitative descriptive retrospective observational design was used to describe the effect of air mattresses on the prevalence and incidence of pressure ulcers among adult post-cardiac surgical patients. A convenience sample of patients, who underwent cardiac surgeries, above fourteen years of age, and stayed at least one day in cardiac surgical intensive care unit during a six month period (1st April – 1st October, 2012) were enrolled in this study. Data was extracted from the patient's charts and electronic medical records in a retrospective manner. Statistical Package for Social Scientists 20.0 was used to analyze the data

Results: Of 224, three patients developed stage two pressure ulcers over the sacral area (1.3%) comparing to 2.76% during the same period in 2011. The prevalence rate was 2.9% comparing to 7.67% reported in 2011. The results showed no statistical significant differences between the patients who developed pressure ulcers and the patients who were free of pressure ulcers. Length of stay and operating time duration were significant predictors for pressure ulcers development (p values, 0.006 and 0.051 respectively)

Conclusion: Using air mattresses for cardiac surgical patients might help in reducing the incidence of pressure ulcers in Cardiac Intensive Care Unit. The length of stay and operating time were identified as the main risk factors in pressure ulcer development.

Keywords: Pressure ulcer; incidence; prevalence; Kingdom of Saudi Arabia; length of stay; OR time..

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Introduction:

Background:

Pressure ulcers (PU) also called bedsores, pressure sores, and decubitus ulcers remain a significant and complex health problem in hospitals and community health care setting in terms of human suffering, pain, disfigurement, loss of productive time, and financial burden (Hopkins et al, 2006; Gorecki et al, 2009; Posnett et al, 2009; Baharestani et al, 2010). Limited mobility as well as various contributing risk factors may influence the development of PU in hospitalized patients.

PU is defined as a localized injury to the skin and/or underlying tissue, usually over a bony prominence. This occurs as a result of pressure or pressure in combination with shear and/or friction. (National Pressure Ulcer Advisory Panel [NPUAP] and European Pressure Ulcer Advisory Panel [EPUAP], 2009).

PU represents a substantial burden in health care systems. It is a major cause of morbidity and mortality particularly in elderly and immobile patients (Posnett et al, 2009). In addition, it is very costly (Cullum et al, 2004). It was estimated at 2.3 - 3.1 billion Euros annually in the United Kingdom accounting 3% of the annual National Health System (NHS) expenditure in 2005/2006 (Posnett & Franks, 2007). In addition, the cost of treating a single full thickness PU is as high as 70,000 US dollars and the total cost for treatment of PU in the United States is estimated at 11 billion US dollars per year (Reddy et al, 2006).

Cardiac surgical patients being cared for in a Cardiac Surgical Intensive Care Unit (CSICU) may be potentially at high risk of developing PU within the first five days post-surgical procedure (Feuchtinger et al, 2007; Schoonhoven et al 2002).

Despite many strategies (skin care, nutrition, mobilization, etc.) to reduce the incidence and prevalence of PU, occurrence remains high. Reddy et al (2006) review reported that 60,000 patients will die every year from hospital-acquired PU. In view of this fact, Health Organizations such as the one in this study have adopted different strategies to prevent PU development. One of these interventions is utilizing support surfaces during the patients' hospital stay. According to European Pressure Ulcer Advisory Panel (EPUAP) and National Pressure Ulcer Advisory Panel (NPUAP) (2009, cited in Rafter, 2011) support surfaces are defined as 'specialized devices for pressure redistribution designed for the management of tissue load'.

Despite the implementation of the above mentioned strategies to prevent PU occurrence, the prevalence and incidence remains high.

Aim of the Study

The primary aim of this study was to describe the effect of the air mattress (Total Care P500®) on PU prevalence and incidence rates among adult post cardiac surgeries patients in the intensive care unit of one of the largest tertiary Hospital in the capital of the Kingdom of Saudi Arabia. The secondary aim was to identify any significant relationship between the variables analyzed in the study as risk factors of development of PU. The rationale for this study was the high prevalence of PU among post cardiac surgery patients within the authors' Organization in 2011, which was approximately 6.5% among all cardiac surgical patients.

Methodology

A convenience sample was used in this study. A quantitative research method and observational design have been utilized. The sample included all cardiac surgical patients who had cardiac surgical intervention during the selected study time frame (April 1st -October 1st, 2012). The study sample included all adult patients above 14 years old, admitted to CSICU after a cardiac surgical procedure and staying equal or more than one day. Non-cardiac patients, subjects younger than 14 years old (as they are classified as pediatric patients in the Organization), and those who were in the unit prior to April 1st 2012 were excluded. In order to achieve a power of 80%, a minimum sample size of 221 patients was required for a moderate effect. A significance level of 0.05 is the aim and considered significant. A total of 16 variables were included in the study.

Results

A total of 238 patients were admitted to CSICU during the period between April 1st and October 1st, 2012. Of these 238 patients, 14 were excluded as they did not meet the inclusion criteria. One patient was in the unit before the starting date of the study and 13 patients were excluded because they were non-cardiac patients and stayed less than one day.

The sample consisted of 224 patients who underwent cardiac surgeries, greater than 14 years old, and had a CSICU stay more than one day. Of 224 patients, 130 (58%) were male and 94 (42%) female. The patients' age ranged from 15 to 92 years old (mean, 50; SD, 16.5). The most common primary diagnosis was Ischemic Heart Disease (IHD) experienced by 109 (49%). Eighty eight patients (39%) had Valvular Disease. Only two patients (0.9%) had both diagnoses (IHD and Valvular Disease), and 25 (11.2%) were classified as "others" which included cardiomyopathy, congenital heart disease, and pericardial effusion. The length of stay (LOS) from admission to discharge or death ranged between one to thirty five days (mean, 3.7; SD 5.2 days). The majority of patients admitted were known to have diabetes mellitus (DM) either type one or two (134 patients, 60%). Patients spent a mean of 5.6 hours (SD 1.87) in the operative room with a range of 2 to 15 hours. The admission to CSICU Body Mass Index (BMI), calculated as the weight in kilograms divided by height in meters squared, ranged between 15 and 41.4 kg/m² (mean, 28; SD, 18.7). Patient's BMI was classified as obese (38.4%), overweight (30.8%), normal weight (24.6%), and underweight (6.3%). The BMI distribution is summarized in (Figure 1)

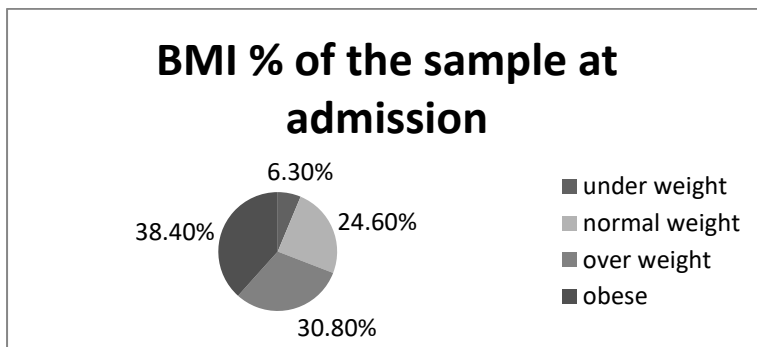


Figure 1: Body Mass Index (BMI) distribution of the sample (n=224)

During this study one of the peri-operative morbidities analyzed on the day of admission was renal impairment. On admission, 19 patients (8%) had renal failure while 205 (92%) had normal renal function. Also, only one of 224 patients was not on mechanical ventilator support on admission to intensive care after surgery (0.5%) while 223 (99.5%) were mechanically ventilated. Braden Scale scores ranged from 6 to 22 (mean, 12.9; SD, 2.5). Ninety two patients (41.1%) fell into being at high risk, 71 (31.7%) were classified as at moderate risk, forty eight (21.4%) were identified as being at risk, eight patients (3.6%) were at very high risk, and only five (2.2%) patients had no risk of developing PU. Scores obtained from the Braden Scale for predicting PU risk are listed in (Figure 2).

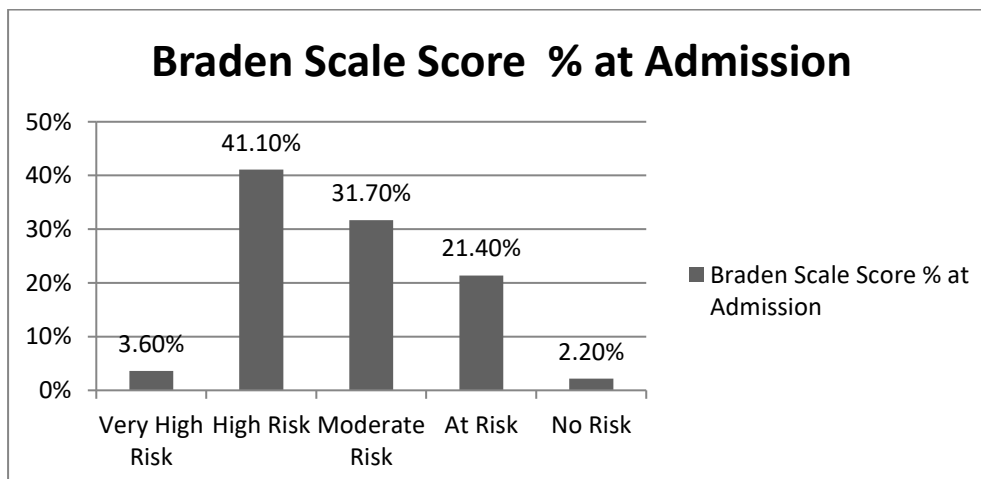


Figure 2: Braden Scale Scores for the Study Sample (n=224)

The vast majority of patients were immobile on admission (210; 94%). However, 14 patients (6%) were categorized as dependent on care givers in term of mobility. All subjects with diagnosis of IHD (109; 49%) had coronary artery bypass graft (CABG). Eighty eight patients (39%) had a valve surgery. Additionally, one (0.4%) of the two patients who were diagnosed with IHD and Valvular Disease, had both CABG and valves surgery. All remaining 26 subjects (11.6%) enrolled within the study were classified under the heading “others”. The hemoglobin level on admission to CSICU ranged from 72 to 184 g/l (mean, 103; SD 16.7) and the albumin serum level ranged from 13 to 49 g/l (mean, 29.9; SD, 5.9). Also, 76 patients (34%) were receiving inotropic drugs support at the time of admission to CSICU. Additionally, all patients (224; 100%) on admission were Nil Per Oral (NPO) for a minimum of eight hours prior to surgery and one day post-procedure. The demographic data is summarized in (Table 1).

Table 1- Demographic and Characteristics of the Study Sample (n=224)

Characteristics	Value
Age (years)	50 (SD 16.5)
Male	130 (58%)
Female	94 (42%)
Length of Stay (LOS), days	3.7 (SD, 5.2)
OR time (Hours)	5.6 (SD, 1.87)
Hemoglobin (g/l)	103 (SD, 16.7)
Albumin (g/l)	29.9 (SD, 5.9)
BMI (Kg/m ²)	28 (SD, 18.7)
Admission Diagnosis	
Ischemic Heart Disease (IHD)	109 (49%)
Valves Disease (VD)	88 (39%)
IHD & VD	2 (0.8%)
Other	25(11.2%)
Surgical Procedure	
Coronary Arteries Bypass Graft (CABG)	109 (49%)
Valves repair or replace	88 (39%)
CABG & Valvular	1 (0.4%)
Other	26 (11.6%)
Diabetes (+)	90 (40%)
Diabetes (-)	134 (60%)
Mobility	
Immobile	210 (94%)
Dependent	14 (6%)
Independent	0 (0%)
Renal Failure (+)	19 (8%)
Renal Failure (-)	205 (92%)
Nutritional status	
NPO	224 (100%)
Adequate	0 (0%)
Inadequate	0 (0%)
Vasopressors (+)	76 (34%)
Vasopressors (-)	150 (66%)

Mechanical Ventilated (+)	223 (99.5%)
Mechanical Ventilated (-)	1 (0.5%)
Braden scale score	
Very high Risk	8 (3.6%)
High Risk	92 (41.1%)
Moderate Risk	71 (31.7%)
At Risk	48 (21.4%)
Not at Risk	5 (2.2%)

Values are expressed as n (%) unless otherwise specified. (+)=condition present; (-) =condition absent; BMI=Body Mass Index; all the conditions represent the sample at the admission day post-operative immediately

Findings and historical results of PU surveys

Within our Institution, four PU surveys are conducted annually to measure the PU prevalence. Results are displayed quarterly (every 3 months) as a snap shot cross sectional study. Interestingly, in 2011, the survey results identified a clear fluctuation trend of PU prevalence rates in CSICU. Within the first quarter (January-March) results were positive, indicating 0% PU. However, in the second quarter (April-June) the PU prevalence increased to 6.25%, and in the third quarter (July-September) PU increased to 9.09%. Consequently, in the fourth quarter, PU prevalence in CSICU dropped to 6.25%. Ulcers were classified as Unit Acquired Pressure Ulcers (UAPU). In 2012, PU prevalence results indicated 0% during the first and second quarter, while 5.8% was reported in the third and fourth quarters. All CSICU surveys results are summarized in (Figure 3).

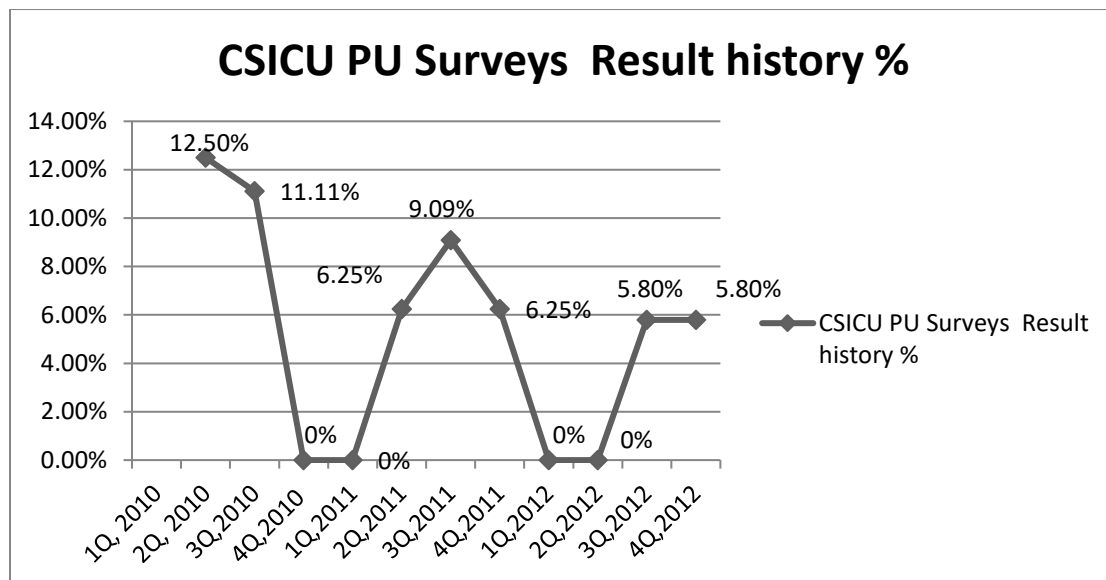


Figure 3: CSICU Pressure Ulcers Surveys Results

This study focused on examining the data results of two quarterly organizational reports while exploring the impact of utilizing air mattresses in CSICU. Data reported an average of 7.67% of PU prevalence rate in the second and third quarter (1st April-1st October, 2011). After introducing the air mattress, during the same period but in 2012 the average PU prevalence was reported to be 2.9%.

In order to explore the incidence of PU in this study's subjects, information was gathered from the hospital database. Results during the second and third quarter (April-October) of 2011 indicated that 217 adult patients were admitted to CSICU. Only six patients had developed PU during their stay in CSICU, having PU stages ranged between stage one and two. However, these results were used as base line data only and will not be compared statistically within this study. This is mainly due to the absence of similar information about this group of patients. Also, it is not the intention of this study to make a comparison between the two groups. In fact, these results will be reviewed from a historical perspective of PU incidence. As a result, the incidence rate of PU during the period of 1st April through 1st October 2011 was 2.7% (6/217). Additionally, during the period from 1st April through 1st October in 2012, results highlighted that from 224 adult patients admitted to CSICU only three patients (1.3%), developed PU stage two over their sacral areas. These results are summarized in (Figure 4).

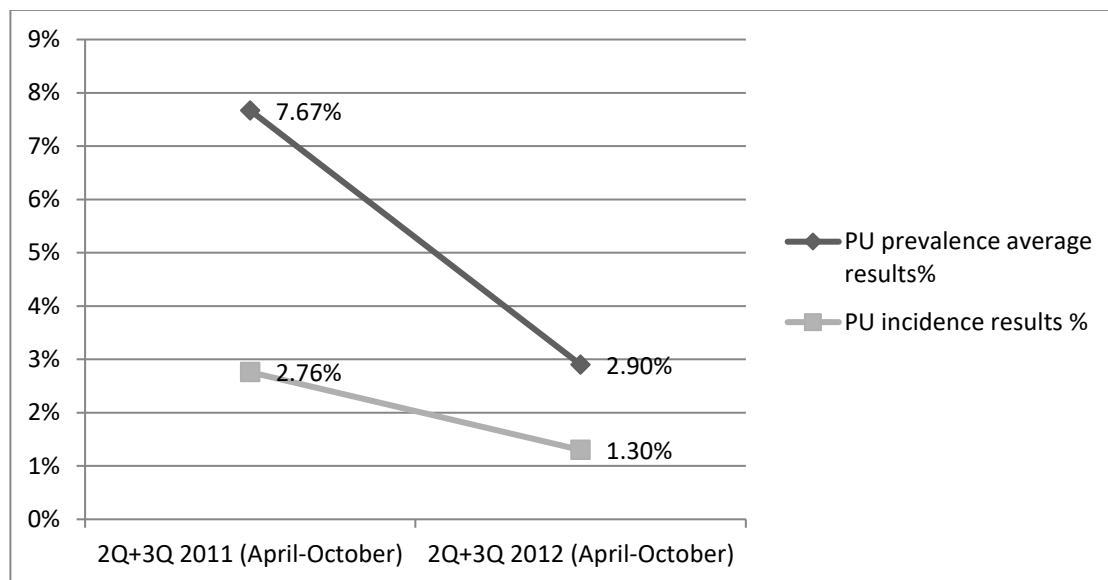


Figure 4: Prevalence (average) and Incidence of PU in 2nd and 3rd Quarter of 2011 and 2012

Inferential statistics

The study data was analyzed using SPSS version 20.0. The relationship between categorical variables and the PU outcome was analyzed by using Cramer's V test and Mann-Whitney U test. Both tests were used to compare the relationship between independent numerical scale-level variables and pressure ulcer outcome.

When searching the database only three patients (n=3) were identified with PU between 1st April and 1st October, 2012. The three patients who developed PU during their CSICU stay were compared to the 221 patients who did not develop PU. As only 3 patients were identified statistical results did not show any significant value because of an imbalance when comparing the 2 groups. However while using Mann-Whitney U and Cramer's V test, a significant value was displayed in length of stay and operating time duration. A statistical imbalance was identified between the two groups (group one with PU n=3; group two without PU n=221). This led to bias in the comparison of the two group's results. The descriptive analysis that follows identified differences between the groups. The mean age of patients

in group 1 was 42.3 years (SD, 11.5) and ages ranged from 31 -54 years. The mean age for patients in group 2 was 50 years (SD, 16.5) with an age range between 15 - 92 years. Statistically, there was no difference in the mean age of the two groups (p-value: 0.309).

In group 1, two out of the three patients who developed PU were female (66.7%). While in group 2 a total of 92 females (42%) and 129 males (58%) remained free of PU (p-value: 0.383). The mean length of stay in CSICU for group 1 was 13 days (SD, 6 days) while group 2 had a mean of 3.6 days (SD, 5.1 days) (p-value, 0.006). Interestingly, patients in group 1 who developed PU spent a mean of 7.33 hours on the operating room table (SD, 1.2) while in group 2, patients spent a mean of 5.6 hours (SD, 1.9) (p-value: 0.051). Patients in group 1 had a mean hemoglobin level of 108 g/dl (SD, 4.3) while group 2 showed no statistical difference 103 g/L (SD, 16.8) (p-value: 0.467). Similarly, mean albumin levels showed no significant difference between the two groups. The mean for patients within the PU group was 25 (SD, 6) g/dl. Group 2 showed a mean of 30 (SD, 5.9) g/dl (p-value, 0.196).

The Body Mass Index (BMI) was calculated on admission day using the height and weight documented in the electronic medical record. Results showed no significant difference between the two groups. BMI within group 1 ranged between 20 to 31 kg/m² with a mean of 26.7 (SD, 6) while in group two the mean BMI was 28.8 (SD, 7.2) kg/m² with a range from 15 to 41.4 kg/m². Patients in group 1 were distributed between normal weight to obese (one patient normal, one patient was overweight, and one patient was classified as obese). Similarly, in group two 14 patients (6.3%) were classified as underweight; 54 (24.4%), normal weight; 68 (30.8%), overweight; and 85 patients (38.5%) were categorized as obese patients. However, there were no statistically differences between the two groups (p-value, 0.958). BMI classifications for the two groups are summarized in (Figure 5 and Figure 6).

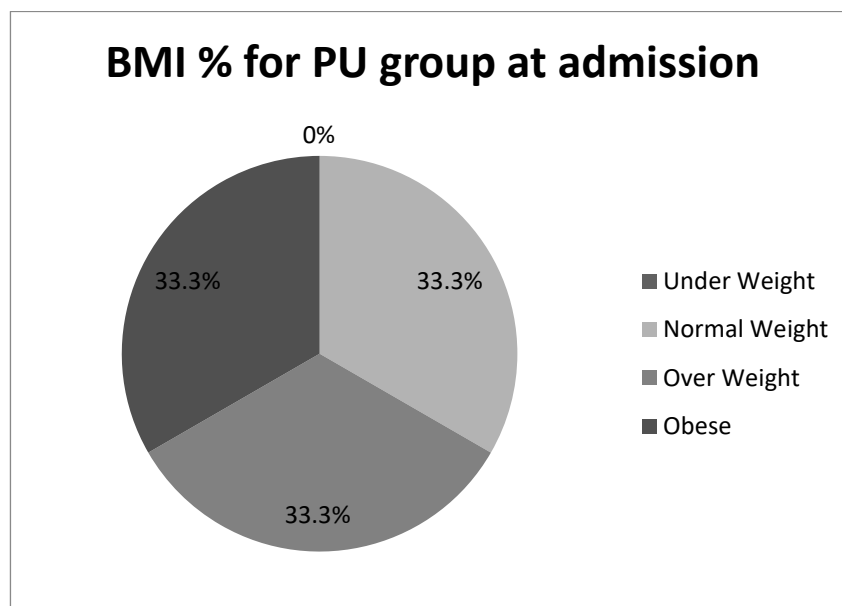


Figure 5: Body Mass Index (BMI) for group one (with PU)

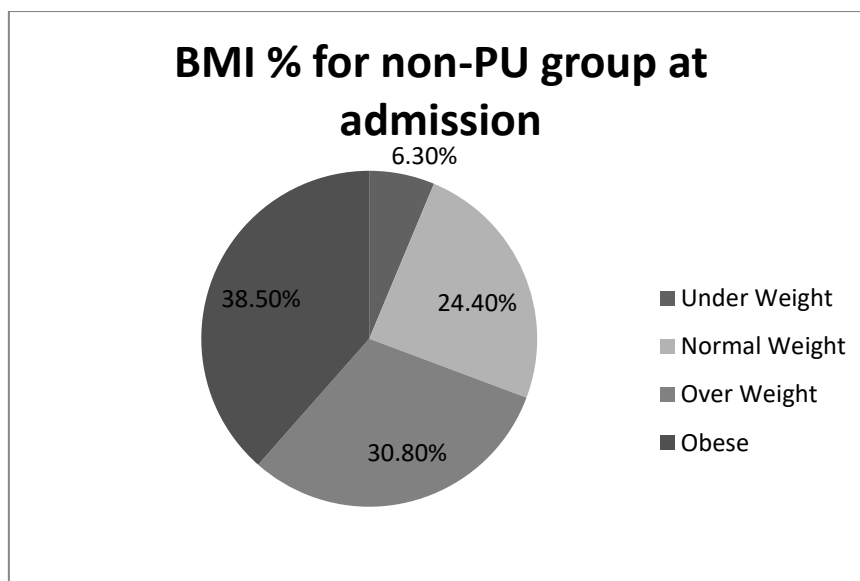


Figure 6: Body Mass Index (BMI) for group two (without PU)

The primary diagnosis for the three patients in group 1 was Valvular Disease and all 3 patients had valves repaired or replaced during surgery. The majority of group two had a diagnosis of IHD (109 patients, 49.3%). However, within group 2 which contained 221 patients, 85 (38.4%) had Valvular Disease. Twenty five patients were placed under “others” category. Only two patients had both diagnosis IHD and Valvular Disease and of these two, one underwent CABG and valve operation, while the other patient underwent a different cardiac procedure was placed under “others” classification.

Two of the three patients (66.7%) in group one had Diabetes Mellitus (DM), while 89 patients (40%) in group two also had DM prior to admission (p-value: 0.808). In terms of mobility on admission day, all patients in group one, were immobile. Also in group 2, 207 patients (93.7%) were immobile at the time of admission. Within group 2 fourteen patients (6.3%) fell under dependent or in need for assistance to move (p-value, 0.904).

There was no renal failure (RF) on admission in group one and only 19 patients (8.6%) from group two had RF on admission (p-value, 0.596).

All of the patients in both groups were NPO on admission. Within this study no statistical analysis was done to examine the nutritional status of patients on admission day. Also, all patients in both groups were admitted after surgery to CSICU on mechanical ventilators with the exception of one patient from group two. This patient was extubated in the operating room prior to transfer to CSICU. Of three patients in group one, two (66.7%) were admitted with at least one inotropic drug such as dopamine, epinephrine, or norepinephrine. In group 2, 74 patients (33.5%) were receiving inotropes on admission, while 147 patients (66.5%) were not receiving any type of inotropic support (p-value: 0.093).

Braden scale scores were extracted from the electronic medical records. In group one only one (33.3%) out of the three patients fell under high risk classification and two (66.7%) were identified as moderate risk of developing

PU. In group two while no patients developed PU, nine patients (4%) were put in a very high risk category, 91 (41%) patients were at high risk. Sixty eight patients were identified (31%) as moderate risk, 49 (22%) patients at low risk, and only four patients (2%) were identified as no risk of developing PU. Braden scale scores for both groups are shown in (Figure 7 and Figure 8).

Both group's statistics including p-values and the type of statistical tests undertaken are displayed and summarized in (Table 2).

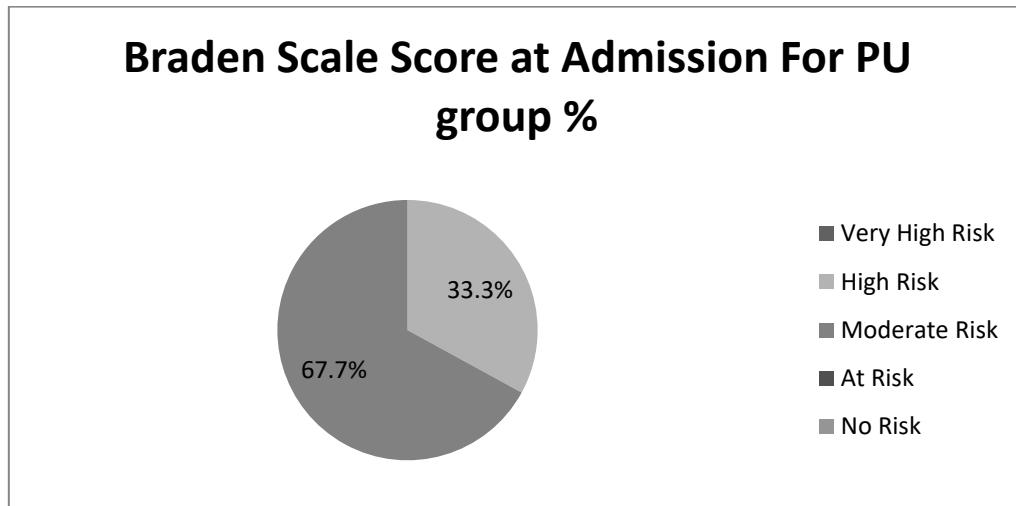


Figure 7: Braden Scale Scores at Admission for Group One (with PU)

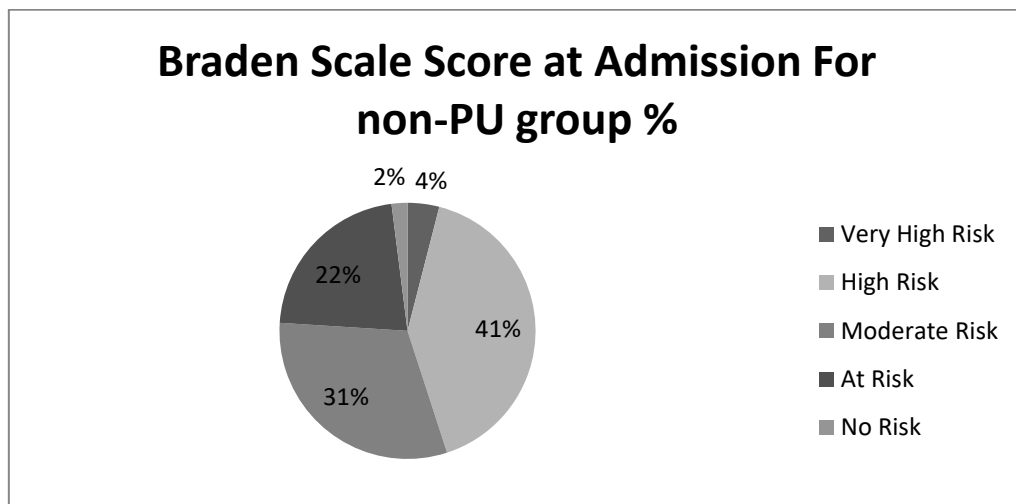


Figure 8: Braden Scale Scores at Admission for Group Two (without PU)

Table 2 Demographics and Characteristics of the Two Groups (1=With PU, 2= without PU)

Variable	Group 1 (with PU) n=3	Group 2 (without PU) n=221	P value	Test
Age (years)	42.3 (SD, 11.5)	50 (SD, 16.5)	0.309	Mann-Whitney
Gender			0.383	Cramer's V
Male	1 (33.3%)	129 (58%)		
Female	2 (66.7%)	92 (42%)		
Length of Stay (days)	13 (SD, 6)	3.6 (SD, 5.1)	0.006	Mann-Whitney
OR time (Hours)	7.33 (SD, 1.2)	5.6 (SD, 1.9)	0.051	Mann-Whitney
Hemoglobin(g/L)	108 (SD 4.3)	103 (SD 16.8)	0.467	Mann-Whitney
Albumin (g/L)	25 (SD 6)	30 (SD 5.9)	0.196	Mann-Whitney
BMI (Kg/m ²)	26.7 (SD 6)	28.8 (SD 7.2)	0.879	Mann-Whitney
Admission Diagnosis			0.195	Cramer's V
IHD	0 (0%)	109 (49.3%)		
Valvular	3 (100%)	85 (38.4%)		
IHD & Valvular	0 (0%)	2 (1%)		
Other	0 (0%)	25 (11.3%)		
Surgical Procedure			0.195	Cramer's V
CABG	0 (0%)	109 (49.3%)		
Valvular	3 (100%)	85 (38.4%)		
CABG & Valvular	0 (0%)	1 (0.5%)		
Other	0 (0%)	26 (11.8%)		
Diabetes (+)	2 (66.7%)	89 (40%)	0.808	Cramer's V
Diabetes (-)	1 (33.3%)	132 (60%)		
Mobility			0.904	Cramer's V
Immobile	3 (100%)	207 (93.7%)		
Need Assistance	0 (0%)	14 (6.3%)		
Independent	0 (0%)	0 (0%)		
Renal Failure (+)	0 (0%)	19 (8.6%)	0.596	Cramer's V
Renal Failure (-)	3 (100%)	202 (91.4%)		
Nutritional status			Omitted	Constant
NPO	3 (100%)	221 (100%)		
Adequate	0 (0%)	0 (0%)		
Inadequate	0 (0%)	0 (0%)		
Vasopressors (+)	2 (66.7%)	74 (33.5%)	0.226	Cramer's V
Vasopressors (-)	1 (33.3%)	147 (66.5%)		
Mechanical Ventilated (+)	3 (100%)	220 (99.5%)	0.907	Cramer's V
Mechanical Ventilated (-)	0 (0%)	1 (0.5%)		
Braden scale score			0.727	Cramer's V
Very high Risk	0 (0%)	9 (4%)		
High Risk	1 (33.3%)	91 (41%)		
Moderate Risk	2 (66.7%)	68 (31%)		
At Risk	0 (0%)	49 (22%)		
Not at Risk	0 (0%)	4 (2%)		

Values are expressed as n (%) unless otherwise specified. (+)=condition present; (-)=condition absent; BMI=Body Mass Index; all the conditions represent the sample at the admission day post-operative immediately except LOS which was measured at death or discharged from CSICU.

Discussion

The purpose of this retrospective descriptive observational study was to describe the effect of a newly introduced air mattress (Total Care P 500®) on PU development among adult patients who underwent cardiac surgeries during their CSICU stay between 1st April and 1st October 2012. The secondary aim of the study was to identify if there was a significant relationship between risk factors and development of PU. This study was conducted retrospectively and, also a historical comparison over the same period of time in 2011 is provided. On 1st April 2012 the new air mattress Total Care P 500® was introduced for all adult patients who underwent cardiac surgeries during their CSICU stay. Measuring the PU prevalence rate using cross sectional surveys is routinely performed through the Department of Quality of the

Organization every three months (quarterly). Therefore, it was easy to compare the prevalence rate of PU in CSICU in the two quarters of the study period. Additionally, the organization measured the incidence rate of PU among patients who were admitted during the same period of six months but in the year 2011. The average prevalence rate of PU development during this period from 1st April to 1st October, 2011 was 7.67%. During the same six month period in 2012 the prevalence average was 2.9%. The incident rate of PU during the same period during 2011 was 2.76% while for the same period in 2012 incident rates was 1.3%. During the study there was no other interventions performed in terms of PU prevention. However, care bundles were performed in accordance to the Organization policy. During the study there was no major incidents reported which could have affected nursing care of the participants. Furthermore, there were no unusual patient care activities that could have influenced the outcome of the nursing care or affected the level of knowledge and skill of the nurses in relation to PU.

Concerning the sample demographics and characteristics, patients who developed PU during the study had no significant age difference. Age ranged from 31 to 54 years, with a mean of 42.3 (SD, 11.5). A study by Frankel et al (2007) reports that age is a risk factor which could influence or increase the risk of PU development. However, the findings in this study suggest that age has no relationship with the development of PU. This contradicts previous studies findings by Sewchuck, et al, 2006; Nijis et al, 2009 who claimed that older patients have a higher risk of developing PU. In this study, age was not a significant factor that could place patients at higher risk of PU development. These findings have also been reported in a study by Tschannen et al (2012). In this study there was no relationship between the patients' gender and PU development (p-value: 0.38). However, these results may be explained due to the small number of patients that developed PU. Based on these results, gender was not found to be a predictor of PU development. Lee et al, (2012) reported similar findings in their study.

This study focused on patients who underwent cardiac surgical procedures, which is considered as a major surgical intervention. Surgical patients are considered at high risk of developing PU if their surgical procedure is preformed over many hours (Bulfone et al, 2012). Additional factors which may increase PU risk, includes cardiopulmonary bypass, use of sedative or paralytic agents and prolonged immobility due to surgical intervention. Researchers have reported no significant relationship between the type of surgery and development of PU. Tschannen et al (2012) affirmed that surgical patients are considered to be at higher risk for PU development. Also, Shahin et al (2008) confirmed that patients who underwent surgical interventions showed a significantly higher prevalence of post-operative PU development. However, Chen et al, 2012 reports a pooled incidence of 18% for PU in cardiac surgical patients. They claimed that cardiac surgery is considered a major procedure which is further highlighted in studies by Cherry and Moss, 2011; Shahin et al, 2008; Tschannen et al, 2012; Sewchuk et al, 2006; Jackson et al, 2011 who reported that all surgical patients are considered at higher risk for PU development.

In this study all subjects were cardiac surgical patients, therefore there was no specific requirement to measure the effect of primary diagnosis and types of surgery as a predicting factor for development of PU. However, the most common preoperative primary diagnosis for this sample was ischemic heart disease and heart valve disease. Also, the three patients who developed PU in this study had valve disease as a primary diagnosis and underwent surgery for valve repair or replacement. In summary, cardiovascular diseases were found to be a significant risk factor in several studies (Capon et al, 2007; Cox, 2011; Feuchtinger et al 2007). Also, cardiac surgical patients were identified to be at higher risk for PU development (Sewchuk et al, 2006; Jackson et al 2011; Bulfone et al, 2012). Due to the type of surgery in this study, no statement has been made to support the other studies finding in terms of primary diagnosis and surgeries types, with development of PU.

The Body Mass Index (BMI) was measured based on weight and height documented in the electronic medical record during admission to the intensive care. All subjects had BMI calculated. Most of the patients had a BMI that was deemed overweight (30.8%) and obese (38.4%), while only 6.3% of the subjects were categorized as underweight patients. This study did not identify any relationship between BMI and development of PU. The three patients who developed PU had an equal distribution between normal weight, overweight and obese patient categories. These findings are similar to other studies in which BMI had no significant relationship with PU development (Feuchtinger et al, 2006; Kaitani et al, 2010; Rich et al, 2011: and Alderden et al, 2011). This could be argued in a study by Tschannen et al (2012) who stated that lower BMI patients were at greater risk for PU than patients who had higher scores of BMI. It is possible that this statement could be valid because of the exposure of the pressure points prominence to the surfaces used under those patients. However further studies would need to be undertaken to validate this hypothesis.

In summary, this study reports that gender, age, cardiac primary diagnosis, cardiac surgeries types, and BMI have no significant relationship with PU development. Although some studies have identified those variables to influence the risk of PU development, this study was unable to predict patients who might at a higher risk of developing PU.

Conclusions

Using air mattresses (Total Care P 500®) for cardiac surgical patients might help in reducing the incidence of PU in Cardiac Intensive Care Unit. The Length of stay and operating time were identified as the main risk factors in Pressure Ulcer development. Further studies are needed to determine the effectiveness of the utilization of air mattresses in prevention of PU.

Study limitation

This study shows considerable strengths as it is one of the first of its kind in the Kingdom of Saudi Arabia. However, several limitations are evident. The retrospective approach by itself is considered a limitation, although most of the variables assessed represent objective data which would not vary with the study design. Utilizing retrospective analysis implies some concern on the generalization of the results when compared to experimentally designed studies. In an attempt to address those concerns, an appropriate methodological procedure was applied and the generalization of findings was considered with caution.

Although this study adds limited evidence to the effectiveness of using an air mattress (Total Care P 500®) on PU development and patient outcomes, it is recommended to conduct a further study utilizing qualitative and quantitative methodologies to answer such questions. Furthermore, this study was conducted on a single unit using a particular group of patients with similar medical diseases. This may make it difficult to extrapolate results in different settings. The sample size was adequate according to statistical tests applied, but when the findings were analyzed it was apparent that group 1 who developed PU was too small and was misbalanced to complete further statistical analysis.

Acknowledgments

We like to acknowledge Mr. Mustafa Sharadqah, Mr. Neil Urmanam, Mrs. Anna Gantt, Dr. Mohammad Shoukri, Dr. Hanna Kadhom, Dr. Catherine O'Neil, and Nursing Affairs for their help and support provided in data collection and writing this manuscript.

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