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Pressure Injury Prevalence and Risk Factors among Adult Critically Ill Patients at a Large Intensive Care Unit

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Abstract

Purpose: To know the pressure injuries prevalence, locations, and stages in the intensive care unit and its associated factors.

Design: Cross-sectional study.

Method: Prevalence study was conducted over six months, from December 2015 to May 2016.

Findings: Prevalence of pressure injury was 35.7% (154 patients out of 431 had at least one pressure injury), this is excluding stage one pressure injuries and the medical device related pressure injuries. The sacrum was the most frequent location of PIs followed by trochanter, ear, heel, buttocks, and ankle. Stage two pressure injuries was the most commonly observed among critically ill patients. We found a significant association between the pressure injuries and the age of patient, Body mass index, and Length of stay.

Conclusion: Measuring prevalence of pressure injuries among critically ill patients is crucial and should be highlighted for all critical care settings.

Key Words: Intensive Care Unit; Pressure injury; Prevalence

affected by microclimate, nutrition, perfusion, co-morbidities and condition of the soft tissue" [1].

Length of Stay (LOS) and cost of care for patient with PIs are found to be higher compared to other hospitalized patients without any PI [2]. The median total hospital charge is \$17200 in patients without PI. In contrast, the median hospital charges for patient with PI are significantly higher at \$36500 [3]. Intensive care unit (ICU) patients have greater than 10-folds higher hospital acquired PI incidence rates than the non-ICU hospitalized patients [4]. In other study, ICU patients are 3.8 times more likely than non-ICU patients to develop PI [5].

Prevalence of PI in the ICU setting varies from one country to another; facility acquired PI prevalence among ICU patients in the USA is from 8.8% to 10.3% [6]. In Australia the prevalence of PI in ICU excluding stage one PI's is 11.5% [5]. The incidence of PIs in two medical/surgical ICUs in Athens, Greece is 29.6% [7]. In level -three general hospitals in Seville (Spain) PI incidence in the ICU is 8.1% [8]. In two governmental hospitals in Saudi Arabia the ICU PI incidence is 39.3% [9].

In their systematic review Alderden et al. [10] studied the risk factors for PI among critically ill patients by reviewing 18 studies on this issue. They found that age is considered as one of the risk factors. Moreover, they defined the mobility/activity as another risk factor for the development of PIs in ICU, majority of patients in ICU are having an issue with mobility/activity because of the use of sedation which is not uncommon in the ICU. The third major risk factor is the poor perfusion which might be secondary to hypotension or other related diagnoses (including diabetes, cardiovascular disease, and peripheral vascular disease). Another risk factor for developing PI in ICU is the infusion of vasopressors resulting in peripheral vasoconstriction, high dose of vasopressors and the infusion of more than one vasopressor are all increasing the risk [10].

Other risk factors in the literature with less attention putting the ICU patients in the risk for developing PI including extreme obesity with body mass index (BMI) ≥ 40 which found to be

Introduction

The National Pressure Ulcer Advisory Panel (NPUAP) redefined the definition of pressure injury (PI) to reflect "localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury can present as intact skin or an open ulcer and may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be

correlated with developing PI among ICU patients, [11] increase LOS in the ICU and being male sex [8,12]. Identifying these factors is crucial for ICU nurses in establishing interventions that can help preventing PIs [8]. Few studies about PIs within ICU patient's populations in hospitals in the Middle East have been conducted and subsequently published. More information about the size of the problem and associated factors related to the development of PIs within patients in ICUs in the Middle East are needed.

Study Aims

The study aimed to answer the following questions:

1. What is the prevalence of PI among critically ill patients in ICU (excluding stage one)?
2. Where are the majority of PIs located?
3. What is the most frequent PI stage in patients admitted to ICU?
4. Is there any association between the development of a PI and other variables?

Methodology

Study design

A Cross sectional study was conducted over six months; data collection was started in December 2015 and completed in May 2016. Based on literature review the authors developed a data collection tool which contains two major parts, the first one is about patient's demographic data and the second describing the PI. The tool has been checked in one ICU on 25 patients and found to be valid and reliable for six months authors selected one day per month to collect the data from the patient's charts using the tool. Before the conduction of the study an educational sessions on the NPUAP 2007 classification system has been given to all ICU nurses. ICU nurses were inspecting the skin of the patient from head to toe at the time of nursing care in the early morning, after that the patient will be assessed again by the wound care practitioner, and then this assessment will be documented in details in the patient's file. At the day of the data collection the primary investigator was collecting the data which has been documented by the staff nurse from the patients' file.

Inclusion and exclusion criteria

All patients who were hospitalized in the ICU during the data collection day were included. Patients less than 16 years old were excluded. Medical device related pressure injuries (MDRPI) were excluded.

Setting

The study was carried out in King Saud Medical City, one of the largest tertiary public medical cities in Saudi Arabia and the Middle East. Saud Medical City has a capacity of 1500 beds. Its ICU is one of the most important departments; it has the

capacity to receive 116 patients (41 trauma patients, 25 medical, 25 surgical, and 25 chronic patients). In order to prevent PIs in our ICU, we implemented some strategies like risk assessment using Braden scale, positioning every two hours, alternating (dynamic) air mattresses and barrier cream.

Study variables

The studied variables were: age, gender, stage of PI, body mass index (BMI), and length of hospital stays before ICU admission (LOS).

Statistical analysis

The study variables were analysed using SPSS 21.0 (IBM Corp., Armonk, NY, USA) and presented as frequencies with percentages [13]. All the parameters were tested at 5% significant level for the difference between the clinical units using Chi-Square test. The association of the parameters with the presence of PI was measured using Risk Ratio and 95% confidence interval.

Results

Demographically, the present study included 292 (67.7% male and 139 (32.3%) female patients. The majority of patients were Saudi nationals 259 (60.1%). Neurological disorders were the most frequently seen (26.7%), then trauma cases (25.5%) followed by infectious diseases (17.2%) and respiratory disorders (13.0%). The prevalence of PI all over ICU was 35.7% (154 patients out of 431 had at least one PI) (**Table 1**). Two hundred and sixty-seven PIs were observed in 431 patients (61.9%). **Figure 1** presents the distribution of patients based on PI stage and location. The sacrum was the most frequent location of PIs followed by trochanter, ear, heel, buttocks, and ankle. Stage two PIs were the most commonly observed among critically ill patients; 143 PIs out of 267 injuries (53.6%).

We found a significant association between patients from different units (Medical, Surgical, Chronic and Trauma) in term of age, gender, BMI, and LOS (**Table 2**). The injuries were observed to be more in the chronic unit followed by the surgical, medical and trauma units.

For every 15 year age interval ranging from 15 to 90 years, an increasing trend in the PI prevalence was observed (14.9%, 24.3%, 40.2%, 46.9% and 59.6% respectively); it was significant with the reference age group (15-30) years. There was a statistically significant association with age group and PI prevalence ($P < 0.001$) with a maximum prevalence (59.6%) in patients aged above 75 years and they had a risk ratio of 8.4, 95% CI (3.9 to 18.1) of developing pressure injuries.

We did observe a statistically significant association between LOS (days) and number of pressure injuries ($\chi^2 = 19.5$ ($P < 0.001$)). When the LOS between one and thirty days the risk ratio is 2.31, 95% CI (1.46 to 3.66). When the LOS was more than 30 days, patients had risk ratio of 4.07, 95% CI (1.82 to 9.10).

Moderately to severely obese patients (BMI 30-40) had 1.81 times higher risk of developing PIs compared to patient's with

normal BMI ($P=0.03$). We found no significant statistical difference between genders in term of developing PIs.

Table 1 Distribution of patients for pressure injuries.

Parameters	Patients N (%)
1. Unit	
Medical	111 (25.8)
Surgical	93 (21.6)
Chronic	98 (22.7)
Trauma	129 (29.9)
2. Total Pressure Injury (including MDRPI)	
Nil	215 (49.9)
One	109 (25.3)
Two	50 (11.6)
Three	44 (10.2)
Four	11 (2.6)
Five	2 (0.5)
3. Number of Non-Medical Device Pressure Injuries	
Nil	277 (64.3)
One	73 (16.9)
More than One	81 (18.8)
4. Stage Two Pressure Injuries	
112 (43.9)	
5. Stage Three Pressure Injuries	
39 (15.2)	
6. Stage Four Pressure Injuries	
24 (9.4)	
7. US Pressure Injuries	
20 (7.8)	
8. SDTI Pressure Injuries	
11 (2.6)	

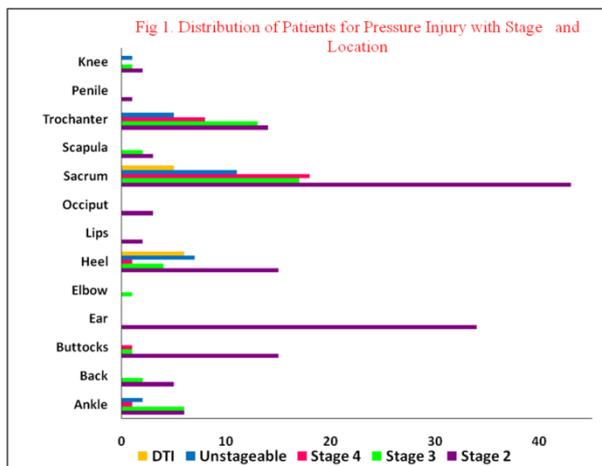


Figure 1 Distribution of Patients for Pressure Injury with Stage and Location.

Table 2 Distribution of patients from different units.

Variables	Medical	Surgical	Chronic	Trauma	χ^2 -value (P-value)
1. Age in Years					
< 65	69	62	59	114	29.19
≥ 65	42	31	39	15	(0.001)*
2. Gender					
Male	64	60	65	103	14.34
Female	47	33	33	26	(0.002)*
3. BMI					
Malnourished	8	16	11	6	-
Normal	32	25	39	53	30.27
Overweight	39	26	27	34	(0.003)*
Obese	29	14	14	29	-
Extremely Obese	3	12	7	7	-
4. LOS-<24 hours					
1-30 days	74	61	53	64	(0.002)*
≥ 31 days	1	7	18	5	-

*Statistically significant at 5% level.

Discussion

According to the Agency for Health Care Policy and Research, U.S. Department of Health and Human Services 1992, it's difficult to interpret data from prevalence and incidence surveys due to several methodological limitations including: (a) difficulty comparing varied populations, (b) differences in whether data was derived from direct observation or retrospective chart review, (c) varying definitions of prevalence, (d) confusion between prevalence and incidence, and (e) exclusion of Stage (Grade) I [14].

Measuring prevalence of PI among critically ill patients is crucial; it may vary from one organization to another. Shahin et al. [15] studied the prevalence of pressure injury among ICU patients in Germany and they found a rate of $\pm 30.0\%$ from 2002 to 2005 which is almost similar to our rate. Heinrichs and Dassen studied the prevalence of pressure injury among 424 patients from 42 Intensive Care Units in Germany and found prevalence rate fell between 20.9% and 39.5% [16]. While we studied the prevalence of PIs in ICU patients regardless of the use of a mechanical ventilator, other investigators measured the prevalence of PIs only on mechanically ventilated patients. Pender and Frazier [17] found that 20.0% of patients developed dermal pressure injury while being on mechanical ventilator in the medical ICU. Most of studies included stage one pressure injury and it was the most common stage [15]. In our study, we excluded stage one and stage two was the most common stage. According to the literature, the most common locations of pressure injury are: ischial, sacrum, and heel [4,5]. In our study,

we found that the ear was a more common location than the heel. While searching for the reason for this we noticed staff were putting an incontinence sheet between the patient's head and bellow to absorb the patient's secretions; more friction will take place between the patient's ear and this incontinence sheet. Putting the patient on 90 degrees side lying position will increase the pressure on the ear and it might be the reason as well.

Many investigators have found significant association between age and the development of PIs which is consistent with our finding [8-10]. Hyun et al. [11] found that obese patients were about two times more likely to develop a PI than patients with normal weight parameters. We found the moderately to severely obese patients at higher risk than the patient with normal weight. LOS before admission to ICU is one parameter that does not appear to have been well studied and reported on before this paper. We found a statistically significant association between LOS (days) and number of pressure injuries.

Recommendations for prevention of PIs among ICU patients including positioning every two hours for high risk patients, early mobilization, early recognition and management of incontinence, prevent hypotension episodes, and minimize the friction and shear.

Study Limitations

A limitation of this study was the use of retrospective chart review for data collection; limitations of this methodology for measuring PIs prevalence include: incomplete documentation (stage one PI, community versus hospital acquired PI), and difficulty interpreting information found in the medical records (e.g. jargon). Data about the severity of illness (APACHE) was not retrieved.

Conclusion

Pressure injuries remain a significant clinical issue in patients admitted to the ICU. Measuring the prevalence of PIs and associated risk factors is crucial for decision makers. In our unit, we found a prevalence rate of 35.7% excluding stage one and MDRPIs. The majority of PIs were located on the sacral area 36.7%, then trochanteric area, ear, and heel (15.6%, 13.3%, and 12.9% respectively). Stage two PI (55.9%) was the most commonly seen PI in our unit. We found a significant association between the PIs and the age of patient, BMI, and LOS. A prevention protocol, guideline or bundle is needed to reduce the incidence of PIs.

Ethical Considerations

The institutional review board at King Saud Medical City approved this study (IRB number: H-01-R-053). Consent form has been waived by the IRB committee.

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