

## Incidence of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit

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### ABSTRACT

**Background and aims:** Cardiac surgery patients are at high risk of pressure ulcers. In the present study, we determined the incidence of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit and related risk factors.

**Methods:** With using convenience sampling all the eligible patients who were admitted to Boali cardiac surgery during June to August 2015 were invited to participate in this study. Patients' skins were assessed using pressure ulcer staging system developed by National Pressure Ulcer Advisory Panel (NPUAP) and Braden scale before operation, after operation (in time of cardiac intensive care unit admission) and one times per day to patients discharge for sign of pressure ulcer development. Data were analyzed using descriptive statistics, Pearson correlation test and independent t-test in SPSS 20.0 statistical software.

**Results:** During 3 months, 70 patients who were eligible were admitted to cardiac intensive care unit. From all, in 32 (45.7%) patient's pressure ulcer was seen. From those, 41.4% were in stage I and 4.3% were in stage II. Mean score of Braden score in time of ICU admission was  $11.1 \pm 2.3$  and  $15.1 \pm 2.3$  in patients with and without pressure ulcer development ( $P < 0.001$ ). Factors such as lower Braden Scale score ( $P = 0.001$ ), diabetes ( $P = 0.01$ ), hypertension ( $P = 0.001$ ), NPO time after surgery ( $P = 0.006$ ), mean time of surgery ( $P = 0.007$ ), mean time of need to mechanical ventilation after surgery ( $P = 0.003$ ), low ejection fraction ( $P = 0.006$ ) and lower level of hemoglobin after surgery ( $P = 0.012$ ) increased the risk of pressure ulcer development significantly.

**Conclusion:** Our findings indicate that patients who were admitted to open heart cardiac surgery intensive care unit are at high risk of pressure ulcer development. Medical and care-giving teams in the cardiac intensive care unit need further education about risk factors of pressure ulcer development to prevent this.

**Keywords:** Pressure ulcer, Risk factors, Cardiac intensive care, Predictive scale.

### INTRODUCTION

Pressure ulcers, also known as bed sores, pressure sores, or decubitus ulcers defined by the National Pressure Ulcer

Advisory Panel (NPUAP) as a localized injury to the skin and/or underlying tissue, usually over a bony prominence that occurs

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as a result of pressure, or pressure in combination with shear.<sup>1</sup> Pressure ulcers are one of the most common types of complex wound that represents a significant health concern as they are associated with distress to the patient, increased strain on nursing resources, increased hospitalization, increased morbidity and mortality rates, and negative impact on the patients' quality of life.<sup>2-7</sup> The rate of pressure ulcer varies widely by clinical setting and the methods that are used for their detection.<sup>8</sup> The prevalence of pressure ulcer (grade 1-4) in Europe countries reported about 18%.<sup>9</sup> The prevalence of pressure ulcers in Iranian hospitals is higher and ranges from 5 to 39.2%.<sup>10-16</sup>

In patients undergoing surgery, the risks for developing pressure ulcers have increased because of multiple challenges to skin integrity including hypothermia, anesthetic agents, hemodynamic changes, position, time, shear, and moisture.<sup>17-19</sup> Results of a relevant study by Schoonhoven et al., showed that 21.2% of patients after the surgery developed some degree of pressure ulcers.<sup>20</sup> Another study performed by Karadag and Gümüşkaya in Turkey. They examined incidence of surgery-related pressure ulcer formation in 84 patients. About 42% of the patients who were surveyed by Karadag and Gümüşkaya developed pressure ulcers in more than one region.<sup>21</sup>

One group of patients under surgery that are in higher risk of pressure ulcer development, are patients undergoing cardiac surgery.<sup>22</sup> In these patients, common risk factors of pressure ulcers in surgery patients are intensified by the use of extracorporeal circulation for the process of cooling and warming, use of underlying water-filled warming pads to help regulate temperature, and delayed return to normothermia during the immediate postoperative period.<sup>17,18</sup> Although identifying the patients at risk of pressure

ulcer development is imperative for implementing cost-effective, evidence-based preventive measure. However, few studies have been carried out in this group of patients (cardiac surgery patients) to assess the risk of pressure ulcer development. So, there is a little knowledge of the risk factors of this group. So in the present study, it was determined the incidence rate of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit and its related risk factors.

## METHODS

This study was conducted in Boali hospital, in Qazvin in North of Iran in 2015. The study received an approval from Research Deputy of Qazvin University of Medical Sciences as well as the head of hospital prior to collection of any data. In addition, written permission was obtained from those who participated in the study after being given some information about the study aims.

Using convenience sampling, all the eligible patients who were admitted to cardiac surgery during June to August 2015 were invited to participate in the study. To be eligible for inclusion, patients had to be 18 years of age or older, to have an expected hospital stay of at least 5 days, and to have an expected time on the operating Table of at least one hour. Those with pressure ulcers on admission and patients who needed emergency surgery were excluded. Patients' skins were assessed using pressure ulcer staging system developed by National Pressure Ulcer Advisory Panel (NPUAP) before the operation, after the operation (in time of cardiac intensive care unit admission) and one times per day to patients discharge for sign of pressure ulcer development by researcher and trained registered nurses.

Pressure ulcers were graded from I to suspected deep tissue injury: grade I is “Intact skin with non-blanchable redness of a localized area usually over a bony prominence”, grade II is “Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink bed wound, without slough”, grade III is, “Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed”, grade IV is “Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the bed wound”, Unstageable is “Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the bed wound” and Suspected Deep Tissue Injury is purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear.<sup>1</sup> First, a check list was designed to obtain the background information that was assumed to influence pressure ulcer development in this group of patients. It included age, sex, previous history of hospital admission, previous history of surgery, previous history of pressure ulcer, diabetes, anemia, hyperlipidemia, smoking, BMI, fasting blood sugar, hemoglobin level, blood creatinin level, time of surgery, type of surgery, time of being under mechanical ventilation, NPO time after surgery, creatinin and hemoglobin after surgery, ejection fraction and fasting blood sugar after surgery. A Braden scale was also used to predict the risk of pressure ulcer development. This scale consisted of six subscales (1) mobility, (2) activity, (3) sensory perception, (4) skin moisture, (5) nutrition state and (6) friction/shear. The items in 5 subscales were scored between 1 and 4. The items in one subscale (friction/shear) were scored between 1 and 3. The total scores ranged from 6 to 23. The

lower Braden scale score indicates a higher risk for pressure ulcer development. Different cut-off scores that are indicative of patients at different risk for pressure ulcer development is suggested as follows: (1) 19–23: no risk, (2) 15–18: mild risk, (3) 13–14: moderate risk, (4) 10–12: high risk and (5) 9 and less: very high risk and were filled at the time of ICU admission. Previous study in Iranian intensive care unit reported the alpha coefficient 0.78 for Braden scale.<sup>23</sup>

A Kolmogorov–Smirnov test indicated that the data was sampled from a population with a normal distribution. Descriptive statistics (mean and standard deviation), Pearson correlation test and independent t-test were used to analyze the data. The data were analyzed using SPSS statistical software and a variable was found to be statistically significant if  $P < 0.05$ .

## RESULTS

During 3 months, 70 eligible patients were admitted to cardiac intensive care unit. 62% of them were men and 38% were women. The mean age of patients was 63.4 years.

From the all, 32 (45.7%) patients developed pressure ulcer. From those, 41.4% were in stage I and 4.3% were in stage II. Most common site for pressure ulcer development was buttocks (59%). Mean score of Braden score in time of ICU admission was  $11.1 \pm 2.3$  and  $15.1 \pm 2.3$  in patients with and without pressure ulcer development. Independent t-test showed that there is a significant difference between Braden scale score and developed pressure ulcer so that the lower Braden scale score creates the higher risk for pressure ulcer development ( $P < 0.001$ ). The results of 6 subscales of Braden scale are shown in Table 1.

**Table 1:** Risk factors of pressure ulcer development

Variables		With pressure ulcer	Without pressure ulcer	P
Sex (n)	Men	17	26	0.190
	Women	15	12	
Smoking	Yes	8	10	0.90
	No	24	28	
Diabetes	Yes	19	27	0.01
	No	13	17	
Hypertension	Yes	26	15	0.001
	No	6	23	
Hyperlipidemia	Yes	30	37	0.355
	No	2	1	
Anemia	Yes	0	1	0.456
	No	32	37	
Age (years)		66.9±11.4	65.7±12.4	0.70
NPO time (h)		12.37±3.56	10.68±1.97	0.006
Cratinin level before surgery		1.04±0.18	1.10±0.32	0.112
Cratinin level after surgery		1.12±0.25	1.10±0.29	0.857
Hemoglobin level before surgery		11.17±1.65	11.18±1.77	0.934
Hemoglobin level after surgery		10.72±1.69	10.46±0.99	0.012
Intubation time (h)		7.06±3.16	5.55±1.20	0.003
Surgery time (h)		5.34±0.97	4.40±0.50	0.007
Ejection fraction		46.25±12.04	50.13±8.09	0.006

Among demographics characteristics that were surveyed in the present study, factors such as diabetes (P=0.01), hypertension (P=0.001), NPO time after surgery (P=0.006), mean time of surgery

(P=0.007), mean time of need to mechanical ventilation after surgery (P=0.003), low ejection fraction (P=0.006) and lower level of hemoglobin after surgery (P=0.012) were studied (Table 2).

**Table 2:** Mean score of Braden scale score in patients with and without pressure ulcer

Items	Patients with ulcer	Patients without ulcer	P
Ability to respond meaningfully to pressure-related discomfort	1.56±0.50	1.94±0.46	0.002
Degree to which skin is exposed to moisture	1.90±0.8	3.50±0.72	0.001
Degree of physical activity	1.21±0.49	1.31±0.57	0.449
Ability to change and control body position	1.81±0.47	2.05±0.61	0.068
Usual food intake pattern	2.81±0.93	3.62±0.71	0.001
Friction and shear	1.84±0.67	2.76±0.43	0.001
Total Braden scale score	15.1 ± 2.3	11.1 ± 2.3	0.001

## DISCUSSION

Cardiac surgery patients are at high risk of pressure ulcers because of restricted

movement associated with surgery, diagnostic procedures, and cardiac assistive

devices.<sup>23</sup> The purpose of this study was to determine the incidence of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit. According to the findings, patients who were admitted to cardiac surgery intensive care unit are at higher risk of pressure ulcer development stage I and II.

Similar to results of present study, results of previous study in this regards showed that critically ill patients who are admitted to Iranian cardiac intensive care units are at high risk of pressure ulcer development.<sup>24,25</sup> In a study, Alizadeh Ghavidel et al. determined the incidence of pressure ulcers after cardiac surgery and its relevant factors in Tehran. They reported that in 22 percent of patients pressure ulcer was developed. Similar to our finding all wound detected by Alizadeh Ghavidel et al., were stage I and II.<sup>24</sup> In another study in 2004, incidence of pressure ulcer reported to be about 37 percent.<sup>25</sup> International studies also showed similar finding. In one study in 2007 in Germany, Feuchtinger et al. reported that near 50% of patients after cardiac surgery developed pressure ulcer. Similar to our finding, all ulcers detected by Feuchtinger et al., were stage I (98%) and II (2%).<sup>26</sup> In other study in Brazil, 20.9% of patients who participate in Carneiro et al., study developed pressure ulcer.<sup>27</sup>

Although Iranian healthcare agencies have made efforts to decrease the incidence and prevalence of pressure ulcers in hospital settings in recent years, pressure ulcers remain a significant clinical problem across Iranian hospitals especially in intensive care units.<sup>12,28</sup> Results of the present study also showed that factors such as lower Braden scale score, diabetes, hypertension, NPO time after surgery, mean time of surgery, mean time of need of mechanical ventilation after surgery, low ejection fraction and lower level of hemoglobin after surgery increased the risk of pressure ulcer

development. In this regards, Alizadeh Ghavidel et al., reported that factors such as hypertension, myocardial infarction, intraoperative hypoxemia, inotropic drugs, low blood pressure, reoperation, decreased hematocrit and length of ICU stay increased the risk of pressure ulcer development in this group of critically ill patients.<sup>24</sup> Another study in 2003, mentioned lower Braden scale score, age, female sex, and heart failure as risk factors for the development of pressure ulcers.<sup>29</sup>

## CONCLUSION

Our findings indicate that patients admitted to open heart cardiac surgery intensive care unit are at high risk of pressure ulcer development in Boali Hospital in Qazvin. Pressure ulcers are preventable through simple interventions, such as identifying patients who are at higher risk of pressure ulcer development before surgery using risk-evaluation scale such as Braden scale, using surface support material in time of surgery, protecting patients' skin from excess moisture, protecting the skin during patient transfer, repositioning patients, documenting prevention interventions, using of pressure-redistribution beds for patients who are at higher risk in time of ICU admission, using of comprehensive, interdisciplinary approach to prevent and manage pressure ulcer and educate personnel about pressure ulcer prevention.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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