

# Prevalence of pressure ulcer among patients who were admitted to open heart surgery intensive care unit

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**Abstract: Background & Aim:** Although identifying the patients at risk of pressure ulcer development is imperative, however, few studies have been carried out in Cardiac surgery patients to assess the risk of pressure ulcer development. In present study, we examined the prevalence of pressure ulcer and some related risk factors among critically ill patients who were admitted to open heart surgery intensive care unit.

**Methods:** This cross sectional study was conducted in ran in 2016. With using sampling formula, 82 patients that were eligible patients were selected. Patients' skins were assessed using pressure ulcer staging system developed by National Pressure Ulcer Advisory Panel (NPUAP) before the operation, in time of cardiac intensive care unit admission and one times per day to patients discharge. Demographics check list and Braden scale also completed for each patient.

**Results:** The mean age of patients was 60.9±10.5. Of them, 46 (56.1%) were male and the rest were female. From the 82 patients that participated in present study, 27 (32.9%) patients developed pressure ulcer (mostly stage I). Patients' age, mean times of intensive care unit stay, diabetic patients, patients who have previous surgery, smokers and patient with pump on situation were related to pressure ulcer development in intensive care unit. The mean score of Braden scale also were statistically higher in patients without ulcer in compared to patients with ulcer ( $p<0.05$ ).

**Conclusion:** According to finding of present study, pressure ulcers especially stage 1 and 2 are common among cardiac surgery patients. Health care worker especially nurses should pay more attention to this topic. Further study recommended in this regards.

**Key words:** Bed sore, Surgery patients, risk factors, Prevalence.

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## 1. INTRODUCTION

Pressure ulcer also named bed-sore, decubitus ulcer, pressure sore and sometimes as pressure necrosis or ischemic ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence as a result of pressure, or pressure in combination with shear and/or friction [1, 2, 3, 4, 5, 6]. Pressure between the bony prominence and external surface occludes the capillaries. The normal capillary pressure ranges from 16 to 33 mm Hg in different segments. External pressure of more than 33 mm Hg occludes the blood vessel so that the underlying and surrounding tissues become anoxic and if the pressure continues for a critical duration, cell death will occur, resulting in soft tissue necrosis and eventual ulceration [6].

According to National Pressure Ulcer Advisory Panel (NPUAP) and European Pressure Ulcer Advisory Panel (EPUAP), pressure ulcers are classified into six category/stages includes: "stage 1 or nonblanchable erythema (Intact skin with non-

blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area), stage 2 or partial thickness skin loss (Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum filled blister, stage 3 or full thickness skin loss (in this stage subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling), stage 4 or full thickness tissue loss (Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling, Unstageable (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 wound bed and suspected deep tissue injury 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. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue” [7].

The cost of Pressure ulcers and related complication is very high. Results of one study in this regards in the United States revealed that the cost of treating pressure ulcer in stage IV was about USD 129,248 and 124,327 in the hospital setting and community-based setting respectively [8]. 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 Cardiac surgery patients to assess the risk of pressure ulcer development [9]. In present study, we examined the prevalence of pressure ulcer and some related risk factors among critically ill patients who were admitted to open heart surgery intensive care unit.

### Methods

This cross sectional study was conducted in cardiac intensive care unit of Boali Sina hospital, in Qazvin, Iran in 2016. The study received an ethical approval from Qazvin University of Medical Sciences 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. With using sampling formula, 82 patients that were eligible patients were selected. Inclusion criteria in present study were, having tendency to participate in study, having elective cardiac surgery and 18 years of age at least. Patients with pressure ulcers on admission for surgery were excluded.

Patients' skins were assessed using pressure ulcer staging system developed by National Pressure Ulcer Advisory Panel (NPUAP) before the operation, in time of cardiac intensive care unit admission (when patients GSC were 8 and higher) and one times per day to patients discharge from cardiac intensive care unit. Skin assessment was performed by researcher (MS). Pressure ulcers were graded from I to suspected deep tissue injury. A check list was designed to obtain the background information that was assumed to influence pressure ulcer development. It included patient's age, sex, previous history of pressure ulcer, diabetes, anemia, hyperlipidemia, smoking, BMI, fasting blood sugar, hemoglobin level and blood cratinin level. A Braden scale was also used to predict the risk of pressure ulcer development. Braden scale completed three times; 1) before surgery; 2) in time of cardiac intensive care unit admission (when patients GSC were 8 and higher) and 3) in time of patients discharge from cardiac intensive care unit. The Braden 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 five subscales were scored between 1 and 4. The items in one subscale (fraction/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 [10, 11, 12].

All statistical analyses were performed using SPSS software (v17.0; PASW Statistics) with using descriptive statistic (mean and standard deviation), Pierson correlation test and independent t test and one. Variable was considered to be statistically significant if  $P < 0.05$ .

## Results

### Demographics characteristics

The mean age of patients was  $60.9 \pm 10.5$ . Of them, 46 (56.1%) were male and the rest were female (range between 36 to 78). The mean time of cardiac intensive care unit stay was  $2.8 \pm 0.9$  (range between 2 to 6 day). The mean score of patients BMI were  $26.6 \pm 4.6$  (range between 13 to 40). Of 82 patients 50% were diabetics. About 67% have high level of blood pressure and 19% have high level of blood cholesterol.

### Pressure ulcer development

From the 82 patients that participated in present study, 27 (32.9%) patients developed pressure ulcer. Most of pressure ulcers developed in day two after admission to cardiac intensive care unit. From those who have stage I pressure ulcer, 4.9% were developed stage II. According to results of independent t test, mean score of patients age were higher in patients who developed pressure ulcer in compared to patients without pressure ulcer significantly ( $67.5 \pm 7.1$  vs  $57.7 \pm 10.4$ ) ( $p=0.001$ ). The mean times of intensive care unit stay also were higher in patients with pressure ulcer in compared to patients without pressure ulcer ( $3.3 \pm 1.2$  vs  $2.6 \pm 0.7$ ). According to results of independent t test this difference between groups were statistically significant ( $p=0.002$ ). Results of Chi square test showed that, diabetic patients, patients who have previous surgery, smokers and patient with pump on situation have more pressure ulcer in compared to other patients significantly ( $p<0.05$ ). although mean level of patients hemoglobin and fasting blood glucose were higher in patients without pressure ulcers in compared to patients with pressure ulcers, however this difference were not statistically significant ( $p>0.05$ ). According to chi square test, patients sex, high blood pressure, hyperlipidemia, and having cerebral vascular attack have note any effect on pressure ulcer development significantly ( $p>0.05$ ).

Results about mean score of Braden scale presented in tables 1, 2 and 3. According to the results of independent t test, mean score of Braden scale in two times (in time of intensive care unit admission and in time of patients discharge) were statistically higher in patients without ulcer in compared to patients with ulcer ( $p<0.05$ ).

**Table 1: The mean score of Braden scale before surgery in patients with and without pressure ulcer**

Items	Patients with ulcer	Patients without ulcer	P value
Ability to respond meaningfully to pressure-related discomfort	$4 \pm 0.0$	$4 \pm 0.0$	1
Degree to which skin is exposed to moisture	$3.66 \pm 0.55$	$3.94 \pm 0.22$	0.002
Degree of physical activity	$3.96 \pm 0.19$	$3.98 \pm 0.13$	0.60
Ability to change and control body position	$3.96 \pm 0.19$	$3.98 \pm 0.13$	0.60
Usual food intake pattern	$3.29 \pm 0.77$	$3.78 \pm 0.41$	0.001
Friction and shear	$2.96 \pm 0.19$	$3.01 \pm 0.1$	0.15
Total Braden scale score	$21.66 \pm 1.33$	$22.25 \pm 2.99$	0.330

**Table 2: The mean score of Braden scale in time of intensive care unit admission in patients with and without pressure ulcer**

Items	Patients with ulcer	Patients without ulcer	P value
Ability to respond meaningfully to pressure-related discomfort	1.03± 0.19	1.85± 0.73	0.001
Degree to which skin is exposed to moisture	2.11± 0.93	3.41±0.83	0.001
Degree of physical activity	1.00± 0.01	1.18±0.43	0.03
Ability to change and control body position	1.29± 0.46	1.78±0.68	0.001
Usual food intake pattern	2.81±0.92	3.50±0.69	0.001
Friction and shear	1.51±0.70	2.98±1.60	0.001
Total Braden scale score	9.77 ± 1.86	14.01 ± 2.74	0.001

**Table 3: The mean score of Braden scale in time of intensive care unit discharge in patients with and without pressure ulcer**

Items	Patients with ulcer	Patients without ulcer	P value
Ability to respond meaningfully to pressure-related discomfort	4± 0.0	4± 0.0	1
Degree to which skin is exposed to moisture	3.77± 0.42	3.98±0.13	0.002
Degree of physical activity	4± 0.0	4± 0.0	1
Ability to change and control body position	4.00± 0.0	3.96±0.19	0.15
Usual food intake pattern	3.51±0.75	3.83±0.37	0.01
Friction and shear	2.96±0.19	3.00±0.01	0.15
Total Braden scale score	22.18± 0.92	22.78 ± 0.53	0.001

### Discussion

Pressure ulcer development is a globally health care problem that negatively affects the patient's quality of life and increases the rate of hospital morbidity and mortality [13, 14, 15, 16, 17]. One group of patients that are at high risk of pressure ulcer is patients undergoing surgery. In present study, we examined the prevalence of pressure ulcer and some related risk factors among critically ill patients who were admitted to open heart surgery intensive care unit after cardiac surgery. According to finding of present study, pressure ulcers especially stage 1 and 2 is common among this group of patients. Results of present study also showed that, diabetic patients, patients who have previous surgery, smokers and patient with pump on situation have more risk of pressure ulcer development in compared to other patients.

Cardiac surgery patients usually remain immobile for long periods of time in the operation room prior to their admission to a ward. Nurses in the operation rooms and cardiac intensive care units may focus on the care of patients with life threatening conditions and pay less attention to skin care. Although risk of pressure ulcer among cardiac surgery patients is high [18, 19, 20], however study about this group of patients is limited to few studies. In one study in this regards, Shokati Ahmadabad et al., examined the incidence of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit and related risk factors. they assessed patients' skins with using pressure ulcer staging system developed by 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. During 3 months, 70 patients investigated by Shokati et al. the incidence of pressure ulcer reported by Shokati et al., were 45.7% that is high similar to finding of present study. Results of Shokati et al., study also revealed that factors such as, lower Braden Scale score, diabetes, hypertension, NPO time after surgery, mean time of surgery, mean time of need to mechanical ventilation after surgery, low ejection fraction and lower level of hemoglobin after surgery increased the risk of pressure ulcer development in this group of patients [8]. In another study, salsali et al., examined the effects of hydrocolloid dressing in prevention of pressure ulcer in patients undergoing coronary artery bypass surgery. The incidence of pressure ulcer in patients in Salsali et al., study that not used hydrocolloid dressing were 38% that is similar to finding of present study [21]. In other study in 2016, Ramezanpour et al., examined the incidence of pressure ulcers and related factors in 250 patients after open heart surgery in two teaching hospitals in Iran. The incidence of pressure ulcers in Ramezanpour et al., study were 32% that is similar to finding of present study. Factors such as patients age more than 70 years, history of renal disease, acidosis during surgery, moisture of the skin during surgery, use of inotropic agents after surgery, and acidosis after surgery determined as risk factors for pressure ulcer development in Ramezanpour et al., study [22].

International studies also showed that cardiac surgery patients are at high risk of pressure ulcer development. In one study in this regards in Unite State Papantonio et al., examined the incidence and risk factors that relate to the development of sacral pressure ulcers following elective cardiac surgery in 136 adult patients. Incidence of pressure ulcer by Papantonio et al., were 27.2%, including 16 Stage I and 21 Stage II-III. Papantonio et al., study also revealed that factors such as older age, transfer from another hospital, and a history of diabetes, were associated with ulcer development [23]. In other study in Belgium, Stordeur et al., examined the rate and risk factors of pressure ulcers. In cadence of pressure ulcer in Stordeur et al., study were 29.5% and factors such as Norton and Braden scores, hemoglobin concentration, presence of ulcers at admission, use of antihypertensive drugs, systemic use of corticosteroids, nosocomial infection, re-intervention and readmission in intensive care units were related to pressure ulcers development [18]. In other study in 2007, Feuchtinger et al., examined the risk of pressure ulcer development with using three commonly used risk assessment instruments (The modified Norton scale, the Braden scale and the 4-factor model) in patients after cardiac surgery. Results of Feuchtinger et al., study revealed that, more than 60% of patients were at risk by the 4-factor model, more than 70% by the modified Norton scale and more than 80% by the Braden scale [24].

### Conclusion

Although several effort performed by health care facilities to decrease incidence and prevalence of pressure ulcers, however this problem is common across all health care settings. Present study aimed to examine prevalence of pressure

ulcers among patients who admitted to cardiac intensive care unit after cardiac surgery. Results of present study showed that risk of pressure is high among this group of patients. Detection of a pressure ulcer at its earliest stage is imperative to afford intervention [25]. Nurses who deal with these patients in operation room and in intensive care unit have an important role in prevention and management of pressure ulcers so they are required to have sufficient knowledgeable about pressure ulcers, their classification and prevention. Further study in this regards recommended.

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#### Conflict of interest

No

#### REFERENCES

- [1] AhmadiNejad M, Rafiei H. Pressure ulcer incidence in intensive care unit patients in Bamonar Hospital, Kerman. J Iran Soc Anaesthesiol Intensive Care. 2011; 57: 10-6.
- [2] Iranmanesh S, Rafiei H, Sabzevari S. Relationship between Braden scale score and pressure ulcer development in patients admitted in trauma intensive care unit. Int Wound J. 2012; 9(3): 248-52.
- [3] Iranmanesh S, Rafiei H, Foroogh Ameri G. Critical care nurses' knowledge about pressure ulcer in southeast of Iran. Int Wound J. 2011; 8(5): 459-64.
- [4] Rafiei H, Mehralian H, Abdar ME, Madadkar T. Pressure ulcers: how much do nursing students really know? Br J Nurs. 2015; 24(Sup6): S12-S7.
- [5] Iranmanesh S, Tafti AA, Rafiei H, Dehghan M, Razban F. Orthopaedic nurses' knowledge about pressure ulcers in Iran: a cross-sectional study. J Wound Care. 2013; 22(3): 138-40, 42-3.
- [6] Agrawal K, Chauhan N. Pressure ulcers: Back to the basics. Indian J Plast Surg. 2012 May;45(2):244-54.
- [7] National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide. Emily Haesler (Ed.). Cambridge Media: Perth, Australia; 2014.
- [8] Shokati Ahmadabad M, Rafiei H, Alipoor Heydari M, Bokharaei M, Amiri M. Incidence of pressure ulcer in patients who were admitted to open heart cardiac surgery intensive care unit. Int J Epidemiol Res. 2016; 3(1): 12-18.
- [9] Brem H, Maggi J, Nierman D, Rolnitzky L, Bell D, Rennert R, Golinko M, Yan A, Lyder C, Vladeck B. High cost of stage IV pressure ulcers. Am J Surg. 2010 Oct;200(4):473-7.
- [10] Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for Predicting Pressure Sore Risk. Nurs Res. 1987;36:205-210.
- [11] Kring DL. Reliability and validity of the Braden Scale for predicting pressure ulcer risk. J Wound Ostomy Continence Nurs. 2007 Jul-Aug;34(4):399-406.
- [12] Hyun S, Vermillion B, Newton C, Fall M, Li X, Kaewprag P, Moffatt-Bruce S, Lenz ER. Predictive validity of the Braden scale for patients in intensive care units. Am J Crit Care. 2013 Nov;22(6):514-20.
- [13] Moore Z, Cowman S. Quality of life and pressure ulcers: a literature review. Wound (UK). 2009;5 (1), 58–65.
- [14] Moore Z, Cowman S, Conroy RM. A randomized controlled clinical trial of repositioning, using the 30 tilt, for the prevention of pressure ulcers. J Clin Nurs. 2011; 20 (17–18): 2633–2644.
- [15] Haleem S, Heinert G, Parker MJ. Pressure sores and hip fractures. Injury. 2008; 39 (2): 219–223.
- [16] Gallagher P, Barry P, Hartigan I, McCluskey P, O'Conno rK, O'ConnorM. Prevalence of pressure ulcers in three university teaching hospitals in Ireland. J Tissue Viability. 2008; 17 (4): 103–109.
- [17] Rafiei H, Abdar ME, Iranmanesh S, Lalegani H, Safdari A, Dehkordi AH. Knowledge about pressure ulcer prevention, classification and management: A survey of registered nurses working with trauma patients in the emergency department. Int J Orthop Trauma Nurs. 2014; 18(3): 135-42.

- [18] Stordeur S, Laurent S, D'Hoore W. The importance of repeated risk assessment for pressure sores in cardiovascular surgery. *J Cardiovasc Surg (Torino)*. 1998 Jun;39(3):343-9.
- [19] Rao AD, Preston AM, Strauss R, Stamm R, Zalman DC. Risk Factors Associated With Pressure Ulcer Formation in Critically Ill Cardiac Surgery Patients: A Systematic Review. *J Wound Ostomy Continence Nurs*. 2016 May-Jun;43(3):242-7.
- [20] Pokorny ME, Koldjeski D, Swanson M. Skin care intervention for patients having cardiac surgery. *Am J Crit Care*. 2003 Nov;12(6):535-44.
- [21] Salsali M, Shaban M, Kamali P, Naderii poor A. Use of hydrocolloid dressing in patients under coronary artery bypass graft surgery. *Hayat*. 2004; 10(22): 39-49. Feuchtinger J, Halfens R, Dassen T. Pressure ulcer risk assessment immediately after cardiac surgery--does it make a difference? A comparison of three pressure ulcer risk assessment instruments within a cardiac surgery population. *Nurs Crit Care*. 2007;12(1):42-9.
- [22] Ramezanpour E, Shafipour V, Heidari Gorji M, Yazdani Charati J, Moosazadeh M. The Incidence of Pressure Ulcers after Open Heart Surgery and Related Factors. *IJNR*. 2016; 11 (3) :74-81.
- [23] Papantonio CT, Wallop JM, Kolodner KB. Sacral ulcers following cardiac surgery: incidence and risks. *Adv Wound Care*. 1994 Mar;7(2):24-36.
- [24] Moore Z, Patton D, Rhodes SL, O'Connor T. Subepidermal moisture (SEM) and bioimpedance: a literature review of a novel method for early detection of pressure-induced tissue damage (pressure ulcers). *Int Wound J*. 2016 Apr 29.
- [25] Feuchtinger J, Halfens R, Dassen T. Pressure ulcer risk assessment immediately after cardiac surgery--does it make a difference? A comparison of three pressure ulcer risk assessment instruments within a cardiac surgery population. *Nurs Crit Care*. 2007;12(1):42-9.