

OCCURRENCE AND SURGICAL MANAGEMENT OF PRESSURE ULCER AMONG PATIENTS ADMITTED IN ICU OF TERTIARY CARE CENTRE

¹Dr Marshal Nagpal, ²Dr Gopal Swaroop Bhargava, ³Dr Seema Mittal, ⁴Dr Raveena Kaur, ⁵Dr Amuleek Kaur

^{1,2,3,4,5}Department of General Surgery, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Sri Amritsar, Punjab, India

Corresponding author:

Dr Gopal Swaroop Bhargava (gsbhargava914@gmail.com)

ABSTRACT

AIM: To study the occurrence and surgical management of pressure ulcer (PU) in patients admitted in ICU of tertiary care centre.

OBJECTIVES: To determine the risk factors, common sites and outcome of surgical management of pressure ulcers.

MATERIALS AND METHODS: Interventional study carried out at Sri Guru Ram Das University of Health Sciences, Vallah, Sri Amritsar on 74 patients who developed pressure ulcers during their stay in ICU.

RESULTS: In our study, 1050 patients were admitted in the ICU's during the period of January 2023 to March 2024. During their stay, 74 patients among them developed pressure ulcers i.e **incidence was 7.04%**. Most of them were Grade 1 which were conservatively managed followed by Grade 2 and 3 which were surgically managed. None of the pressure ulcer progressed to grade 4. Most common causes for such event were continuous pressure at particular point, fecal and urinary incontinence, immobility and impaired sensory perception. Sacrum, ischial tuberosities, calcaneum and shoulders were the most common sites which were frequently involved.

CONCLUSION: In this study it was noted that maximum number of risk factors which were responsible for the formation of pressure ulcer was preventable. Therefore, it is very important to select appropriate and applicable preventive measures (nursing care, materials, devices and staff education). Pressure ulcer adds unnecessary burden and cost to intensive care patients. This study concludes that 'Prevention is always better than cure'.

KEYWORDS: Pressure ulcers, ICU, occurrence, surgical management.

INTRODUCTION

A pressure ulcer is an area of localised skin damage and underlying tissue caused by pressure, shear, friction and/or a combination of these. Because of the high incidence and severe consequences of pressure ulcers, prevention is essential in the care for the intensive care unit (ICU) patients.^[1] The terms decubitus ulcer (from Latin decumbere, "to lie down"), pressure sore, bedsores and pressure ulcer are often used interchangeably. Pressure ulcer involves damage to the soft tissues of the skin including epithelial, dermal, subcutaneous tissues, fat and muscle. Pressure ulcers are caused due to prolonged mechanical deformation of soft tissues between internal stiff anatomical structures (bones, cartilages, tendons) and external stiff support surfaces (e.g. mattresses or seats).^[2] Patients in many

intensive care units are sedated and ventilated and therefore unable to move or care for themselves. Movement is a defense to pressure, but this defence is lost during a critical illness due to conditions such as neurological disorder, renal impairment, shock or vascular failure.

The magnitude of pressure ulcers in intensive care cannot be determined accurately by prevalence studies because patients are often admitted to ICU with existing pressure ulcers. Moreover, assessing the course of pressure ulcers after admission to ICU helps to trace whether pressure ulcers could be healed or whether they deteriorated to a higher grade.^[3] Measuring and monitoring the prevalence or incidence of PUs in hospital patients is, therefore, an important part of strategic patient safety work and has become a key focus for many healthcare institutions around the world. The first step in PU prevention is identifying patients who are at risk. The second step is to reliably implement prevention strategies for all at-risk patients. The risk identification process uses a structured risk assessment, including skin assessment, and is a well-established approach.^[4]

Risk factors in pressure sore development can be environmental or systemic. Environmental include pressure, shear, friction. Systemic include patient's age, weight, mobility, mental status, nutrition, hypoproteinemia, inadequate moisture and predisposing disease. Risk factors involved in pathogenesis of ulcers may be intrinsic, extrinsic or both. Risk assessment of developing pressure ulcers can be performed using Braden scale. Braden evaluates 6 factors – level of sensory perception, skin moisture, level of activity, mobility, nutrition and friction /shear – with worst score of 1 and favourable score of 3 or 4.^[5] Intrinsic factors relate to patient status. Slower epidermal turnover and decreased vascularity, subcutaneous adiposity, collagen and elastin content are seen in aging skin.^[6]

Mechanical loads applied to soft tissues are all the types of forces that can possibly act upon skin and underlying tissues of an individual as a result of contact between the skin and an external surface, object, or medical device. These loads include the bodyweight forces typically transferred through bony structures into soft tissues. External mechanical loads are often characterised as being a normal force (acting perpendicularly to the skin) or a shear force (acting parallel to skin). In real-world scenarios, external forces always have normal and shear components. Pressure is defined as normal force per unit surface area (of skin or underlying tissue). Shear stress is likewise defined as the shear force (acting in a direction that is parallel to the skin or underlying tissue surface) per unit surface area. The term friction is used as an abbreviation of the “coefficient of friction” to describe interface properties and the potential for sliding of two surfaces with respect to each other. Shear deformations and stresses on the skin surface is associated with friction phenomenon, within skin layers and subcutaneously, which may be static (if there is no relative movement between the skin and the contacting surface/object/device) or dynamic (when such relative movement occurs).^[7]

STAGING OF PRESSURE ULCER

- Stage 1: Non-blanching erythema, with intact epidermis.
- Stage 2: Partial thickness skin loss involving epidermis and dermis.
- Stage 3: Full thickness skin loss extending through dermis in to subcutaneous tissue.
- Stage 4: Deep tissue destruction extending through fascia and may involve muscle, bone and tendons.



Fig.1 (A) Stage 1 PU



fig.1 (B) Stage 2 PU



fig.1 (C) Stage 3 PU



fig.1 (D) Stage 4 PU

fig.1 A to D: Represents the different stages of pressure ulcers

AIM

To study the occurrence and surgical management of pressure ulcer in patients admitted in ICU of tertiary care centre.

OBJECTIVES

1. To determine the risk factors of pressure ulcer.
2. To determine the common sites of pressure ulcer.
3. To determine outcome of surgical management of pressure ulcers.

MATERIALS AND METHODS

Study Design: Interventional study

Duration: 1st January 2023 to 31st March 2024

Participants: The study was conducted at Sri Guru Ram Das University of Health Sciences, Sri Amritsar. 15 months duration was considered for noticing the occurrence and surgical

management of pressure ulcer among patients admitted in ICU in current study after taking written and informed consent.

INCLUSION CRITERIA:

1. Patients who developed pressure sores after getting admitted in ICU.
2. Patients who developed pressure sores during their stay in ward and was then shifted to ICU.

EXCLUSION CRITERIA:

1. Patients who presented to OPD with primary diagnosis of pressure sores.
2. Patients presented with skin allergies.
3. Patients lost to follow up.
4. Patients who have stayed in ICU for less than 48 hours.

Methodology:

- In this study clinical examination [general physical, systemic and local examination] was done in admitted patients and were further subjected to hematological tests, biochemical tests and viral marker tests.
- Common sites for pressure ulcers were examined in each patient which include occiput, elbow, sacrum, ischium, heel.
- Six criteria according to BRADEN SCALE were examined to assess the patient's risk to develop pressure ulcer i.e Sensory perception, Mobility, Moisture, Activity, Nutrition and Friction and shear.

Six criteria according to BRADEN SCALE were examined to assess the patient's risk to develop pressure ulcer and the patient was looked for the signs of pressure sores for grading it according to National Pressure Ulcer Advisory Panel i.e.Redness, Swelling, Loss of epidermis, Ulcer, Blenching and Colour.

- **On the day of patient's admission in ICU**
- **After 72 hours of admissions**
- **On every alternate day till 7th day, 14th day and then on day of discharge.**

OBSERVATIONS AND RESULTS

In this study, patients who were admitted in ICU were observed for occurrence of pressure ulcers and how they were further managed. Among 1050 patients, which were observed during the period from 1st January 2023 to 31st March 2024, 74 patients developed pressure ulcer and the **incidence** was found out to be **7.04%**. Various risk factors were observed for pressure ulcer development and were managed accordingly.

Majority of the patients who developed pressure ulcers were observed to be belonging to age group of 61-70 years of age (29.7%) followed by less than 30 years of age (17.6%), more than

70 years of age (14.9%), 41-50 years of age (14.9%), 31-40 years of age (12.2%), 51-60 years of age (10.8%) with mean age of 52.19 ± 17.97 .

In our study, it was observed that maximum number of pressure ulcers developed were grade 1 (85.1%) followed by grade 2 (10.8%) and grade 3 (4.1%). No pressure ulcer progressed to grade 4.

In our study it was observed that most common site of pressure ulcer formation was sacrum (83.8%) followed by calcaneus (23%), ischial tuberosity (14.9%) and shoulder blade (4.1%).

Braden Scale scoring of all the 74 patients who developed pressure ulcers in intensive care unit was done on the day of admission and day of discharge, the scoring being as follows:

- The mean score of **sensory perception** on day 0 was 3.55 ± 0.83 and on DOD was 3.84 ± 0.41
- The mean score of **moisture** on day 0 was 1.96 ± 0.26 and on DOD was 3.07 ± 0.34
- The mean score of **activity** on day 0 was 1.62 ± 0.57 and on DOD was 3.09 ± 0.67
- The mean score of **mobility** on day 0 was 2.24 ± 0.62 and on DOD was 3.55 ± 0.5
- The mean score of **nutrition** on day 0 was 1.69 ± 0.87 and on DOD was 3.42 ± 0.5
- The mean score of **friction and shear** on day 0 was 2.16 ± 0.41 and on DOD was 3.92 ± 0.27

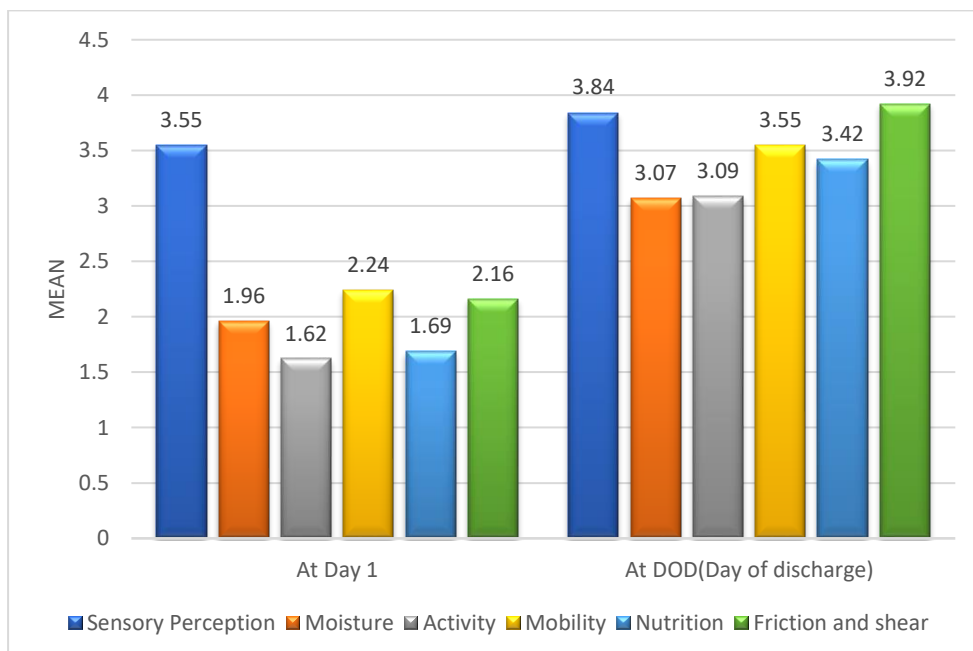


Fig 2. Shows comparison of mean score of all components of Braden scale at day 0 and at day of discharge.

On comparison of the Braden scale scoring of the pressure ulcers in patients on the day of admission and day of discharge, the difference came out to be clinically and **statistically highly significant ($p < 0.001$)**. This showed that each parameter observed on the day of admission clinically improved at the time of discharge.

It was observed in our study that Grade 1 that is 63 out of 74 patients (85.1%) were conservatively managed.

Grade 2 and Grade 3 that is 11 out of 74 patients (14.9%) were surgically managed.

It was observed that 11 patients who developed pressure ulcers were surgically managed. Out of which 8 patients (72.7%) who developed Grade 2 PU were managed with multiple debridements and regular dressings.

3 patients developed Grade 3 pressure ulcer, out of which 1 patient (9.1%) was managed with Rotational flap and other 2 patients (18.2%) were managed with Split skin grafting.

DISCUSSION

Some experts believe that intensive care units (ICUs) are among the most aggressive, stressful, and upsetting hospital environments for patients, despite being the best place to care for critically ill patients. Other elements that impair their psychological structure include isolation, numerous therapeutic interventions, lack of sleep-promoting settings, dread of the disease getting worse, and fear of dying. All of these things hinder their ability to improve overall.^[8] Previous reports of the incidence of PUs in ICU patients have varied widely, the incidence of PU in our study was 7.04 %. In the study done by Rogenski and Kurcgant^[9], the incidence of pressure ulcers in admitted ICU patients were found to be 23.1%. The reason for low incidence can be because of the preventive measures like educating to patient, attendants, healthcare staff on the regular basis. Regular daily rounds in the surgical, medical, general ICU's had a major impact on reducing the incidence of pressure injury. In the various studies done on pressure sores, the incidence was varying between 3-48%. The most common risk factors according to Braden scale were moisture followed by nutrition and activity.

In this study pressure sores are more common in males as compared to females, reason could be that male patient are more involved in outdoor activities where they are likely to encounter with road traffic accidents, fall from height, assault etc. Study done by Byrne & Salzberg *et al.*^[10] found that those most likely to develop pressure ulcers are males, as they are more prone to occupational hazards.

Understanding the influence of comorbidities is essential to comprehending how pressure ulcers form. Multiple chronic diseases coexisting in one patient is referred to as comorbidities. Older people are more likely to develop pressure ulcers as a result of multiple co-morbid conditions such diabetes, hypertension, cerebrovascular accident, and respiratory disorders. In this study, 40.5% of the patients who acquired pressure ulcers also had diabetes mellitus, and 28.4% had hypertension. According to a study by Margolis *et al.*^[11], 7.4% of older persons in the ICU with pressure injuries had diabetes. This is due to the high prevalence of undiagnosed diabetes and the fact that most people do not seek treatment. The reason is the growing prevalence of unhealthful environments.

Due to diabetes, there is peripheral neuropathy because of which there is decrease in sensory perception which ultimately leads to less mobility and more moisture. So it is the leading comorbid condition associated with pressure ulcer, so does in our study.

Elderly group of patients are more prone to develop pressure ulcers due to texture of skin, immune status, less mobility, low recovery rate from the chronic disease, reduced muscle mass, and frequency of cell replacement. In this study the incidence of pressure injury was highest in the age group of 60-70 years of age (29.7%). The study done by Rogenski & Rasero & Simonetti *et al.*^[12] also reported the risk of developing pressure ulcer among elderly age group is significant and most of them are found to be incontinent.

Most common site of pressure sores in this study was sacral region (83.8%) as mostly the patients were in supine position due to chronic illness, followed by calcaneum (23%), B/L Ischeal tuberosity (14.9%) and shoulder blade (4%). In a study conducted by Whittington *et al.*^[13] for pressure ulcer prevalence and incidence, they showed that the most common site of pressure ulcers were sacrum (26%) and coccyx (31%) .

In this study maximum number of patients had grade 1 bed sores (85.1%), while, (10.8%) patients had grade 2 bed sores and (4.1%) patients had grade 3 bed sores and no pressure sore progressed to grade 4. Similar findings were seen in the study by Fuhrer *et al.*^[14], which involved 87 ulcers with severity ratings available. Of these, 30 (34.5%) were classified as grade I, 33 (37.9%) as grade II, and 24 (27.6%) as either grade III or IV. The study was conducted in the patients who were admitted or shifted in the ICU with no previous pressure injury so most of the pressure sores are grade 1 and early detection and prevention doesn't let pressure sore to progress further.

MANAGEMENT STRATEGIES

After studying the various articles, publications and journals it has been concluded that 'Prevention is better than cure' of the pressure injury. Assessment and management of pressure ulcers require a comprehensive and multidisciplinary approach. Assessment of pressure ulcers should comprise both a local evaluation of the wound and a systemic assessment of the patient. In this study, the incidence of grade 1 pressure ulcer was highest among 74 patients followed by grade 2 and grade 3. The grade 1 pressure ulcers were managed conservatively and the main focus was to further prevent the risk factors which were causing it. Certain measures were taken like repositioning every 2 hourly, changing diapers for incontinence, early oral nutrition intake, air mattress, educating the staff, patient and attendants. Thomas E *et al.*⁵⁸ also emphasize on the use of olive oil massages for treating the grade 1 pressure ulcer. As it is the cost effective method and can be used in the low cost set ups. Grade 2 pressure ulcers were managed with debridement of slough and necrotic tissues and regular daily dressings were done and precautionary measures were taken.

Kaya *et al.*^[15] compared the effectiveness of applying an occlusive hydrogel type dressing to a povidine-iodine soaked gauze dressing and significantly more ulcers healed with the hydrogel dressing. Grade 3 pressure ulcers were managed with multiple debridements and covering the wound with flaps and grafts. Majority of patients were discharged with completely healed pressure ulcer and some were discharged with grade 1 and instructions were given for pressure ulcer care and regular follow up.

CONCLUSION

In this study we have established that pressure ulcer is an additional burden to the chronically ill patients in the intensive care units. It was noted that various risk factors like nutrition, moisture, mobility and comorbidities are responsible for development of pressure ulcers and of which maximum number of risk factors are preventable. This study also supports the

hypothesis that most common sites of pressure ulcers in intensive care patients are sacrum and heel. Therefore, it is very important to select appropriate and applicable preventive measures (nursing care, materials, devices and staff education). It was found that most of the patients developed grade 1 pressure ulcer which were conservatively managed and those who progressed to grade 2 and grade 3 were surgically managed. So pressure ulcer adds unnecessary burden and cost to intensive care patients which can be easily prevented by taking some measures. This study concludes that 'Prevention is always better than cure'.

ACKNOWLEDGEMENTS

The authors would like to thank the department of Surgery and the staff members of all the Intensive Care Units, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar for providing the research material for this study.

Funding: No funding sources

Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCES

1. N, Toppets A, Defloor T, Bernaerts K, Milisen K, Van Den Berghe G. Incidence and risk factors for pressure ulcers in the intensive care unit. *J Clin Nurs*. 2009 May;18(9):1258-66.
2. Kottner J, Cuddigan J, Carville K, Balzer K, Berlowitz D, Law S, Litchford M, Mitchell P, Moore Z, Pittman J, Sigaud-Roussel D. Pressure ulcer/injury classification today: An international perspective. *Journal of Tissue Viability*. 2020 Aug 1;29(3):197-203.
3. Shahin ES, Dassen T, Halfens RJ. Incidence, prevention and treatment of pressure ulcers in intensive care patients: a longitudinal study. *International journal of nursing studies*. 2009 Apr 1;46(4):413-21.
4. Källman U, Hommel A, Borgstedt Risberg M, Gunningberg L, Sving E, Bååth C. Pressure ulcer prevalence and prevention interventions—A ten-year nationwide survey in Sweden. *International wound journal*. 2022 Nov;19(7):1736-47.
5. He W, Liu P, Chen HL. The braden scale can't be used alone for assessing pressure ulcer risk in surgical patients: A meta-analysis. *Ostomy-Wound Management*. 2012 Feb 1;58(2):34.
6. Dharmarajan TS, Ugalino JT. The aging process. *Hospital physician geriatric medicine board review manual*. 2000;1(Part 1):1-2.
7. Shaked E, Gefen A. Modeling the effects of moisture-related skin-support friction on the risk for superficial pressure ulcers during patient repositioning in bed. *Frontiers in bioengineering and biotechnology*. 2013 Oct 14;1:9.
8. Garcia AD, Thomas DR. Assessment and management of chronic pressure ulcers in the elderly. *Medical Clinics*. 2006 Sep 1;90(5):925-44.
9. Rogenski NM, Kurcgant P. The incidence of pressure ulcers after the implementation of a prevention protocol. *Revista latino-americana de enfermagem*. 2012;20:333-9.
10. Byrne DW, Salzberg CA. Major risk factors for pressure ulcers in the spinal cord disabled: a literature review. *Spinal cord*. 1996 May;34(5):255-63.
11. Margolis DJ, Knauss J, Bilker W, Baumgarten M. Medical conditions as risk factors for pressure ulcers in an outpatient setting. *Age and ageing*. 2003 May 1;32(3):259-64.

12. Rasero L, Simonetti M, Falciani F, Fabbri C, Collini F, Dal Molin A. Pressure ulcers in older adults: a prevalence study. *Advances in Skin & Wound Care*. 2015 Oct 1;28(10):461-4.
13. Whittington K, Patrick M, Roberts JL. A national study of pressure ulcer prevalence and incidence in acute care hospitals. *Journal of WOCN*. 2000 Jul 1;27(4):209-15.
14. Führer MJ, Garber SL, Rintala DH, Clearman R, Hart KA. Pressure ulcers in community-resident persons with spinal cord injury: prevalence and risk factors. *Archives of physical medicine and rehabilitation*. 1993 Nov 1;74(11):1172-7.
15. Kaya AZ, Turani N, Akyüz M. The effectiveness of a hydrogel dressing compared with standard management of pressure ulcers. *Journal of wound care*. 2005 Jan;14(1):42-4.