Library Progress International
Vol.44, No.4, July-December 2024: P. 1149-1155

Print version ISSN 0970 1052
Online version ISSN 2320 317X

Original Article

Available online at www.bpasjournals.com

Medical Device related Pressure Injury and its associated factors among patients admitted in Intensive Care Units a tertiary care teaching hospital.

Aishwarya Goswami[1*], Dr. R Ponchitra[2] Dr. Sameer Kadam[3]

1. M.Sc. (N) student, MGM New Bombay college of Nursing, MGM Institute of health sciences, Navi Mumbai, Maharashtra, India.
2. Professor & Vice Principal, MGM New Bombay college of Nursing, MGM Institute of health sciences, Navi Mumbai, Maharashtra, India.
3. Professor & HOD of Surgery, MGM New Bombay college of Nursing, MGM Institute of health sciences, Navi Mumbai, Maharashtra, India.
*Corresponding Author

How to cite this article: Aishwarya Goswami, Dr. R Ponchitra, Dr. Sameer Kadam (2024) Medical Device related Pressure Injury and its associated factors among patients admitted in Intensive Care Units a tertiary care teaching hospital. *Library Progress International, 44(4)*, 1149-1155

ABSTRACT

Introduction: Pressure injuries related to medical devices (MDRPI) in hospitals are well-documented for their risks of infection, discomfort, and healthcare costs. Medical devices can increase the risk of pressure ulcers by exerting pressure, generating heat and moisture, and making it difficult to inspect the skin underneath. To mitigate this, regular skin checks, proper device fitting, and moisture management are essential to prevent skin breakdown and improve patient outcomes. They significantly impact patient well-being and can delay hospital discharge, reflecting nursing care standards. ICU patients, due to immobility and medical equipment exposure, face heightened risks. This study aims to assess MDRPI incidence, identify contributing risk factors, and correlate these injuries with pressure ulcer development to enhance critical care outcomes and patient safety. **Materials and methods:** Quantitative research design was used. Descriptive approach with 162 patients, selected via Cochrane's formula. Inclusion criteria involve adults in ICU for over 24 hours with external medical devices, excluding pediatrics and those with internal devices. Data collected through direct observation will be analyzed using descriptive and inferential statistics. **Results:** The study identified an 82.7% incidence of medical device-related pressure injuries, with arms/hands being the most common site (67.93%). Overall, pressure injuries occurred in 58% of cases, mainly affecting the buttocks (64.2%). Significant associations ($p < 0.05$) were found between these injuries and risk factors including Glasgow Coma Scale, Braden QD score, and skin assessment parameters. **Conclusion: :** The study found an 82.7% incidence of MDRPI in ICU settings, mainly affecting the arms, hands, neck, fingers, nasal septum, and chest. Risk factors included low GCS, high Braden QD risk, underweight BMI, and immobility. Stage 1 injuries started on arms/hands, moving to the chest; Stage 2 began on the lips, shifting to cheeks; Stage 3 started on the foot, moving to the nasal septum. This review underscores the importance of careful evaluation, treatment, and reporting of MDRPI. Vigilant assessment and management of medical devices are critical for enhancing patient safety and healthcare quality in intensive care unit.

Keywords: Intensive care units, Medical device, Pressure injury.

INTRODUCTION

Localized wounds caused by weight to the skin and fundamental delicate tissues commonly happen over hard prominences or in affiliation with restorative or other gadgets. This harm is called a weight damage. The harm may show as an open ulcer or intaglio skin and may cause torment. [1]

Medical devices can increase the risk of pressure ulcers by exerting pressure, generating heat and moisture, and making it difficult to inspect the skin underneath. To mitigate this, regular skin checks, proper device fitting, and moisture management are essential to prevent skin breakdown and improve patient outcomes.[2]

The National Pressure Ulcer Advisory Panel (NPUAP) now includes medical device-related pressure ulcers (MDRPUs) in its definition, recognizing that these ulcers result from therapeutic or diagnostic devices. As the use of medical devices increases, MDRPUs have become more common, with patients using devices being 2.4 times more likely to develop pressure ulcers, leading to increased healthcare costs, patient discomfort, infection risk, and delayed discharge, while also serving as a key indicator of care quality and patient safety.[3]

In Brazil, research on pressure injuries caused by medical equipment is still emerging, with a recent review highlighting the lack of local studies and reliance on foreign literature. A study on pediatric ICU patients found a nationwide pressure injury prevalence of 32.8%, with 94% of at-risk patients using medical equipment, and 25% of these injuries being linked to the devices themselves.[4]

ICU patients are especially at risk for pressure injuries due to factors like immobility, unstable blood flow, inadequate tissue oxygenation, and a combination of complex intrinsic and extrinsic risks. The extensive use of medical equipment, along with the growing number of elderly and long-term ICU patients, further increases their vulnerability to these injuries.[5]

NEED OF THE STUDY

Before 2016, the lack of a clear definition for medical device-related pressure injuries (MDRPIs) caused confusion in diagnosing and assessing prevalence. Pittman et al. (2015) defined MDRPIs as pressure-induced damage to skin or mucosal membranes, following the shape of the device. The NPIAP staging system is used for grading these injuries, but mucosal membrane injuries may require separate recognition.[6]

Preventing MDRPIs requires thorough skin assessments, focusing on both device-impacted areas and other at-risk regions. Nurses should perform at least two daily skin exams, use preventive dressings, ensure proper device fit, and reposition patients regularly. Early detection is challenging due to varying expertise and workload, but implementing an algorithm for detection and management can improve care and outcomes.[7]

MDRPIs affect 62.4% of patients, with the highest prevalence in those using catheters, nasogastric tubes, and orotracheal tubes. Stage 2 injuries commonly affect areas like the auricular region and nasal ala. Factors such as edema, ICU stay, low Braden/Glasgow scores, and device use are linked to higher MDRPI risk, emphasizing the need for prevention and monitoring.[8]

Preventing MDRPIs requires a thorough assessment of both device-impacted and other at-risk skin areas. Nurses should perform at least two daily skin examinations, use preventive dressings, ensure correct device fit, and keep the skin clean and dry. Periodic repositioning and device elevation can reduce pressure. However, early detection can be challenging due to varying nurse expertise, heavy workloads, and concerns about device dislodgement during inspections. Additionally, managing MDRPIs may be hindered by the need for physician approval to adjust devices. To address these issues,

an algorithm for early assessment and effective management should be implemented in clinical practice.[9]

ICU patients are highly vulnerable to pressure injuries due to immobility, unstable blood flow, poor tissue oxygenation, and a mix of intrinsic and extrinsic risk factors. The increased use of medical equipment, along with a growing number of elderly and long-term ICU patients, further heightens their susceptibility.[10]

AIM OF THE STUDY

This study aims to assess MDRPI incidence, identify contributing risk factors, and correlate these injuries with pressure ulcer development to enhance critical care outcomes and patient safety.

MATERIALS AND METHODS

The objectives of the study T MGM New Bombay college of Nursing, MGM Institute of health sciences, Navi Mumbai, Maharashtra, India to assess the incidence of Medical Device related Pressure Injury in Intensive Care Units Patients, to identify the risk factors of Medical Device related Pressure Injury in Intensive Care Units Patients, to associate the Medical Device related Pressure Injury with Pressure ulcers In Intensive Care Units Patients. The present study was conducted in Tertiary care teaching hospital on ICU patients. The descriptive approach with 162 patients selected via Cochrane's formula. Inclusion criteria involve adults in ICU for over 24 hours with external medical devices, excluding pediatrics and those with internal devices. The sample were selected by non-probability purposive sampling technique. Prior approval from the institutional ethics committee was obtained for the study. Informed consent was obtained from the patients and families. The data collection tool finalized by validation of 10 experts and reliability score of 0.89 was used for data collection. Pilot study was conducted on 16 samples to see the feasibility of the tool. In findings of pilot study 56.25% develop Medical Device related Pressure Injury. Data collection was done through direct observation method on daily basis till device is disconnect. The statistical analysis was done with the help of descriptive statistics (mean, Percentage) and inferential statistics (Chi square test) by finding P value.

RESULTS

To begin with, the data was retrieved from Google form sheet for tabulation and statistical processing. The analysis of the data is organized and presented under the following section.

Section 1: Distribution of the Incidence of Medical Device-Related Pressure Injuries.

Table 1: *Distribution of the incidence of medical device-related pressure injury.*

n=162

Characteristics	*(f)*	%
Arms/hand	110	67.9
Neck	91	56.2
Cheek	86	53.1
Finger	82	50.6
Nasal septum	75	46.3
Chest	74	45.7
Nostril	68	42.0
Urethra	63	38.9
Corner of lips	57	35.2
Scrotum	42	25.9
Ear	33	20.4
Lips	31	19.1
Foot	29	17.9
Chin	15	9.3
Legs	14	8.6
Forehead	9	5.6
Breast	6	3.7
Abdomen	1	0.6
Ischium	1	0.6

The Table 1 shows that the majority of medical device-related pressure injuries occur on the arms/hands 110 (67.9%), neck 91 (56.2%), cheek 86 (53.1%), and fingers 82 (50.6%). Other significant sites include the nasal septum 75 (46.3%) and chest 74 (45.7%). These areas are the most frequently affected by pressure injuries in patients.

Section 2: Distribution of Risk Factors Associated with Medical Device-Related Pressure Injuries

Table No. 2: *Distribution of Factors Associated with MDRPI.*

n=162

Factors	Average	Group	(*f*)	%
GCS	8.2	Mild	50	30.9
		Moderate	28	17.3
		Severe	84	51.9
Braden QD	15.51	High Risk	130	80.2
		Low Risk	32	19.8
BMI	19.7	Underweight	87	53.7
		Healthy	60	37.0
		Overweight	15	9.3
Length of ICU stay	1.4 weeks	< 1week	91	56.2
		1-2 weeks	47	29.0
		2-3 weeks	23	14.2
		3-4 weeks	1	0.6
Fluid Balance		Positive	130	80.2
		Negative	32	19.8
Nutrition		Oral	38	23.5
		Enteral	119	73.5
		Parenteral	5	3.1
Position change		Yes	124	76.5
		No	38	23.5
Vasopressor Ad ministration		Yes	87	53.7
		No	75	46.3

Immobility	Yes	125	77.2
	No	37	22.8
Medical Device Attached	Yes	162	100.0
	No	0	0.0
Appropriate Device Size	Yes	162	100.0
	No	0	0.0
Device Secured Properly	Yes	157	96.9
	No	5	3.1
Device Rigid	Yes	23	14.2
	No	139	85.8
Device Aligned Properly	Yes	154	95.1
	No	8	4.9

The Table 2 shows that, in this study Factors associated with the occurrence of medical device pressure injuries are a mean GCS of 8.2. The GCS is severe in the majority of respondents, 84 (51.9%). The mean Braden QD score is 15.51. The majority of respondents had a high-risk Braden QD score 130 (80.2%). The mean BMI is 19.7, with the majority of respondents being underweight 87 (53.7%). The mean ICU stay is 1.4 weeks, with the majority of respondents staying less than 1 week 91 (56.2%). The majority of respondents have a positive fluid balance 130 (80.2%).

The majority of respondents were enterally feed, 119 (73.5%). The majority of respondents who change position, 124 (76.5%) answered yes, and the majority of respondents who administer vasopressors, 87 (53.7%) answered yes. The majority of respondents who are immobile, 125 (77.2%) answered yes. The majority of respondents had been fitted with a medical device – yes, 162 (100%). Appropriate device size, 162 (100%), most devices are safe, yes, 157 (96.9%), and most devices are immobile, no. 139 (85.8%). The majority of devices, 154 (95.1%), were correctly placed.

Section 3: Association of pressure injury with comprehensive skin status and association of medical device-related pressure injury with skin status.

Table: 3 *Association of pressure injury with skin status and Association of medical device related pressure injury with skin status.*

n=162

Pressure injuries		**Compressive Skin Assessment**		**Chi-square**	**d.f**	**P value**	**Significance (P< 0.05)**
		No	**Yes**				
MDRPI	Stage 0	40	73	13.29	2	0.001	S
	Stage 1	4	34				
	Stage 2	0	11				
Pressure Injury	Stage 0	37	76	7.349	2	0.025	S
	Stage 1	7	31				
	Stage 2	0	11				

*S- Significant * NS-Not Significant

The Table 3 shows that, in this study the chi-square was used to see the association between the pressure injury and the compressive skin assessment. The test was conducted at a 5% level of significance,

assuming the null hypothesis that there will be no significant association between pressure injury and compressive skin assessment.

Significant Association:

For the pressure injury variables, MDRPI and pressure injury, the p-value of the association was less than 0.05 ($P<0.05$). That means the pressure injury was associated with these compressive skin assessments.

DISCUSSION: The study highlights a high incidence of medical device-related pressure injuries (MDRPIs) at 82.7%, surpassing rates observed in similar ICU studies. The most common sites for medical device-related pressure injuries are the arms/hands, neck, cheek, fingers, nasal septum and chest. Medical devices like ECG cables and urinary catheters were commonly implicated. Contributing factors include severe Glasgow Coma Scale scores, high Braden QD risk, underweight BMI, short ICU stays, positive fluid balance, enteral feeding, frequent position changes, vasopressor use, and immobility. Comprehensive skin assessments revealed notable skin conditions among patients, underscoring the critical need for preventive strategies in managing MDRPIs and PIs in ICU settings.

CONCLUSION: The study on ICU patients with medical devices found high incidences of MDRPIs (82.7%) and PIs (58%) primarily affecting arms, hands, neck, fingers, nasal septum and chest. Most patients were over 60 (33.3%), male (67.3%), and non-smokers (37.7%), with hypertension (33.3%) and stays under one week (87.7%). Key risk factors for MDRPIs included severe GCS scores, high Braden QD risk, underweight BMI, short ICU stays, positive fluid balance, enteral feeding, frequent position changes, vasopressor use, and immobility. Skin assessments showed warm temperatures, delayed turgor, and bruising but intact skin integrity. MDRPIs evolved stage 1 MDRPIs were most common on the arms/hands initially, shifting to the chest by day 7. Stage 2 injuries started on the lips and moved to the cheeks. Stage 3 injuries began on the foot and shifted to the nasal septum.

This review underscores the importance of careful evaluation, treatment, and reporting of MDRPI. It highlights the significant contribution of various medical devices to MDRPI, the numerous anatomical sites affected, and the different stages of such injuries. Despite the beneficial intent of medical devices, complications can arise from their use. To enhance patient safety and quality of life, it is recommended to conduct further standardized studies, improve evidence-based guidelines, protocols, risk assessments, and education. These measures aim to promote better standards of care and mitigate the risks associated with medical device usage in ICU patients.

LIMITATION: Patients were selected from only tertiary care teaching hospitals, hence restricting the generalizability of the result. The study was conducted only on adult patients. A study was conducted on an ICU patient. The study did not include a control group; hence, the approach was descriptive only.

DELIMITATION: Patients were selected from only tertiary care teaching hospitals, hence restricting the generalizability of the result. The study was conducted only on adult patients. A study was conducted on an ICU patient. The study did not include a control group; hence, the approach was descriptive only.

RECOMMENDATION: A similar study can be conducted with a large sample size to generalize the findings. Similar studies can be conducted on interventions and outcomes. A comparative study can be conducted between wards and ICUs. Similar studies can be conducted in the PICU and NICU. Develop and implement guidelines to control MDRPIs.

REFERENCES:

1. National pressure ulcer advisory panel pressure injury staging system: revised pressure injury staging system. Journal of Wound, Ostomy, and Continence Nursing. 2016 Nov;43(6):585.

2. Black JM, Cuddigan JE, Walko MA, Didier LA, Lander MJ, Kelpe MR. Medical device related pressure ulcers in hospitalized patients. International wound journal. 2010 Oct;7(5):358-65.
3. Celik S, Taskin Yilmaz F, Altas G. Medical Device-Related Pressure injuries in adult intensive care units. Journal of Clinical Nursing. 2022 Sep 15.
4. Jackson D, Sarki AM, Betteridge R, Brooke J. Medical device-related pressure ulcers: a systematic review and meta-analysis. International journal of nursing studies. 2019 Apr 1;92:109-20.
5. Visscher M, Taylor T. Pressure ulcers in the hospitalized neonate: rates and risk factors. Scientific reports. 2014 Dec 11;4(1):1-6.
6. Pittman J, Gillespie C. Medical device–related pressure injuries. Critical Care Nursing Clinics. 2020 Dec 1;32(4):533-42.Galetto SG, do Nascimento ER, Hermida PM, Busanello J, de Malfussi LB, Lazzari DD. Medical device-related pressure injuries in critical patients: prevalence and associated factors. Revista da Escola de Enfermagem da USP. 2021 Aug 23;55.
7. Seong YM, Lee H, Seo JM. Development and testing of an algorithm to prevent medical device–related pressure injuries. INQUIRY: The Journal of Health Care Organization, Provision, and Financing. 2021 Oct 1;58:00469580211050219.
8. Schindler CA, Barrette R, Sandock A, Kuhn E. Medical Device-related Pressure Injuries Associated With Electroencephalogram Leads in a Tertiary Care Children's Hospital: A Retrospective Chart Review. Wound Management & Prevention. 2021 Sep 1;67(9):25-32.
9. Seong YM, Lee H, Seo JM. Development and testing of an algorithm to prevent medical device–related pressure injuries. INQUIRY: The Journal of Health Care Organization, Provision, and Financing. 2021 Oct 1;58:00469580211050219.
10. Visscher M, Taylor T. Pressure ulcers in the hospitalized neonate: rates and risk factors. Scientific reports. 2014 Dec 11;4(1):1-6.