International Journal of Contemporary Pediatrics
Rehman F et al. Int J Contemp Pediatr. 2025 Oct;12(10):1619-1623
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20252955

Original Research Article

Frequency of pressure injuries in a resource limited pediatric intensive care unit of Pakistan: a retrospective study

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Received: 25 July 2025
Revised: 03 September 2025
Accepted: 06 September 2025

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ABSTRACT

Background: Pressure injuries are a significant global healthcare issue, particularly affecting children, who are identified as high-risk. This study aimed to evaluate the frequency, severity and most vulnerable sites of PIs in critically ill children admitted to the Paediatric Intensive Care Unit (PICU).
Methods: We enrolled children aged 1 month to 15 years who stayed in the PICU for over 24 hours from August 1 to December 30, 2023. Two well trained health professionals called skin champions conducted daily comprehensive skin examinations until discharge or death. Location, severity and possible cause of PIs were noted on data collection sheet as well as trend of occurrence noted.
Results: Among 1,196 patients and 3077 skin assessments, 53 (4.4%) PIs were identified. Of these, 32 injuries (60.4%) were related to medical devices MDRPI and 21 (39.6%) were due to pressure alone. The upper trunk was the most common site (75.5%), with the occiput being particularly affected (24%). Stage 1 and Stage 2 PIs accounted for 45.3% and 54.7%, respectively.
Conclusions: Occurrence of PI was lower than in earlier research, while the frequency of MDRPIs was notably higher underscoring the necessity for improved prevention strategies and ongoing risk evaluations.

Keywords: Pressure injury, PICU children

INTRODUCTION

PIs, formerly known as pressure ulcers, have been redefined by the National Pressure Injury Advisory Panel (NPIAP) and the European Pressure Ulcer Advisory Panel (EPUAP) as localized injury to the skin and/or the soft tissues underneath, that usually occurs over bony prominences in conjunction with medical or other devices and caused on by long-term or severe pressure that is frequently made worse by shear forces.[1,2] Both intact skin and potentially painful open ulcers are possible presentations of PIs. With the reported prevalence rates range from 15% to 27%.[3] The occurrence of PIs in PICUs is a significant concern due to the unique vulnerabilities of critically ill children. Children admitted in PICU have greater chances of developing PIs as compared to patients in other acute care settings because of several reasons.[4] Majority of the patients in PICU are sick with complex medical problems, have nutritional compromise disturbances in oxygen caring capacities hypoxia or low haemoglobin and as a result maintenance of skin integrity is very difficult in critical care which increase the chances of PIs.[4-7] These children need continuous close monitoring (both invasive and non-invasive) for which they are attached to medical devices (masks, tubes, cannulas, splints) which most of the time are secured by adhesive tapes. In fact, 80% of the PI in PICU are reported to be medical device related.[8] Immobility due to critical illness or sedation significantly increases the risk of PIs by decreasing pain perception and inability to change positions frequently.[4,9] These injuries not only represent a serious risk to patient safety but also highlight the difficulties in preventing them in critical care

environment. Despite strict adherence to established protocols and the use of advanced technologies, the number of PIs continues to grow. This concerning pattern highlights the necessity for ongoing vigilance and novel strategies to mitigate the factors that predispose children to these preventable catastrophes. PIs are essential indicators of quality of nursing care.[10,11] They are tracked as part of the National Database of Nursing Quality Indicators (NDNQI), which many hospitals utilize to measure and improve the quality of nursing care. While data on adult PIs have gathered significant attention globally, there is limited data on frequency of these injuries in children in PICU especially in lower middle-class countries and that might be one of the reason the prevalence of these injuries in children remains high.[2,4,7]

Objective

Identify the frequency and most susceptible site of development of PIs in patients admitted in PICU.

METHODS

This retrospective descriptive study was done in a 28 bedded closed multidisciplinary PICU of newly opened public-sector Children Hospital Korangi, as "Sindh Institute of Child Health and Neonatology" (SICHN) from August 2023 to December 2023. This PICU followed the model of 4-S frame work [system, space, stuff and staff]. It is a pediatric post-graduate teaching institute including fellowship in Pediatric Critical Care Medicine. The nurse to bed ratio was 2:1. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline were followed for this study. Approval for the study was taken by local IRB (SICHN/EX-012/2024) Karachi.

Participants

All Children 1 month to 15 years admitted in PICU for more than 24 hours between 1st august to 30th December 2023 were included in the study. Those patients who suffered a pressure injury prior to being admitted to the PICU were not included.

Study procedure

Two well trained health professionals called skin champions including a doctor and a nurse did daily head to toe detail skin examination of children admitted to PICU till discharge/death from the unit.[12] PIs were defined and staging done (Box 1) according to NPIAP, EPUAP and Pan Pacific Pressure Injury Alliance (PPPIA), key organizations focused on the prevention, management and treatment of PIs.

Data collection

The data was collected on a structured data spread-sheet including demographic variables age, gender, clinical variables i.e., admitting diagnosis, presence of medical devices (nasogastric tube, oxygen masks, endotracheal tube, saturation probes, IV cannula, electrodes), incident related variables i.e., site of PI and severity (staging) of lesion according to the NPIAP.

Data analysis

Data was analyzed using SPSS Version 26. Frequency and percentages are reported for all categorical variables. Normality was found out using Kolmogorov-Smirnov test. Mean±SD is reported for all Normally distributed numeric variables. Median (IQR) is reported for all Not Normally distributed numeric variables.

RESULTS

During the study 1196 patients were admitted and 130 expired. Among these patients, 692 (57.3%) were male and 504 (42.1%) were female. The majority of admissions were due to respiratory pathologies (64.4%), followed by central nervous system disorders (10%), cardiovascular pathologies (4.2%) and miscellaneous diagnoses (21%). A total of 3077 skin examinations were performed, 53 patients (4.4%) developed pressure injuries. Of these, 32 injuries (60.4%) were related to medical devices, while 21 injuries (39.6%) were attributed to pressure alone (Table 1).

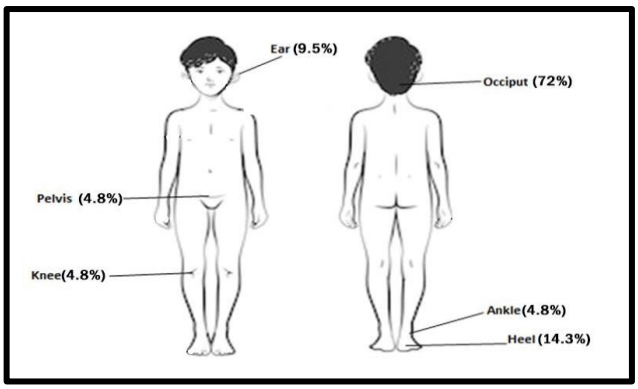

Figure 1: Anatomical location of PIs.

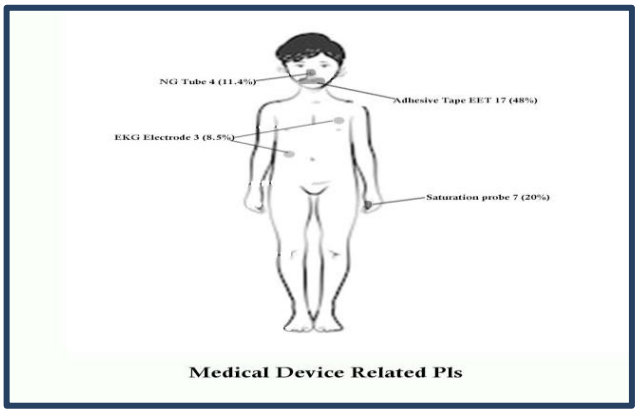

Figure 2: Staging of pressure injuries.

Characteristics of pressure injuries

Out of 32 (60.4%) medical device related PIs 40 (75.5%) occurred on trunk and head, (24.5%) occurred on extremities.[13] Moreover, PIs of grade-I were 24(45.3%) while PIs of grade-II were 29 (54.7%) (Table 1).

Medical device related injuries

Among the medical device-related injuries identified in the study, almost half 17 (48%) were attributed to the adhesive tape used for securing endotracheal tubes, followed by saturation probes placed on the extremities, while 4 (11.4%) occurred due to nasogastric tubes. Furthermore, 3 (8.5%) of the injuries were linked to EKG electrodes (Table 2).

Pressure related injuries

Among the 21 PIs which occurred because of pressure alone figure 1 the majority were located on the occiput, accounting for 13 injuries (61.9%), three injuries (14.3%) were found on the heel, followed by ear 2 (9.5%).

Table 1: Staging of pressure injuries.

Stages	Description
Stage 1	Intact skin with a localized area of non-blanchable erythema (redness), usually over a bony prominence. This may include changes in skin temperature, tissue consistency and/or sensation.
Stage 2	Partial-thickness loss of skin with exposed dermis. The wound bed is viable, pink or red, moist and may present as an intact or ruptured serum-filled blister.
Stage 3	Full-thickness skin loss. Subcutaneous fat may be visible, but bone, tendon or muscle is not exposed. Slough may be present but does not obscure the depth of tissue loss
Stage 4	Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage or bone in the ulcer. Slough or eschar may be present on some parts of the wound bed.
Unstageable	Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar.
Deep tissue pressure injury	Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar.

Table 2: Characteristics of study participants.

Characteristics	N (%)
Age	1 month-15 years
Gender	
Male	692 (57.3)
Female	504 (42.1)
Duration (in months)	5
Total of admission	1196
Total of skin exam	3077
Length of stay (days)	
Median (IQR)	2.79 (1.5-4.9)
Min-Max	0.05-66.11
Diagnostic categories	
Respiratory	771 (64.4)
Cardiac	51 (4.2)
CNS	121 (10)
Misc.	253 (21)
Total pressure injuries	53 (4.4
Type	
Pressure	21 (39.6)
Device	32 (60.4)
Site	
Extremities	13 (24.5)
Trunk and head	40 (75.5)
Grades	
G-I	24 (45.3)
G-II	29 (54.7)

Table 3: Characteristic of medical device related PIs.

Medical device related injuries	N (%)
NG tube	4 (11.4)
Adhesive tape ETT	17 (48)
Saturation probe	7 (20)
EKG electrodes	3 (8.5)

Single injuries were recorded on the ankle, pelvis and knee, each representing 4.7% of the total injuries.

DISCUSSION

During the study frequency of PI was found to be 4.4%. This number was lower than 6.04% as reported by Remzi et al, Razmus et al and Sandra et al reported 3.7% PIs in PICU in a descriptive analysis of data from the NDNQI across 678 paediatric acute care units in 271 U.S. hospitals. According to Zang et al the incidence of PIs was 13.5%.[4,9] In a multicentre study of three PICUs, Curley and colleagues observed a 27% prevalence of pressure injuries, the majority of being stage 1 or 2.[13] The high incidence may be attributed to the variability in the data across different studies. In a retrospective study done by Mishra et al at Fortis Hospital in Bengaluru found 25% incidence of PI, higher incidence of pressure ulcers in this study may be attributed to prolonged immobilization.[14]

We found 60.4% of PIs caused by medical devices out of which 48% were attributed to the adhesive tape used for securing endotracheal tubes. Widati et al approximately 50% of pressure injuries are related to medical devices in children admitted to intensive care with 60% specifically attributed to respiratory devices.[15] Children's anxiety and fear in unfamiliar environments can lead them to inadvertently dislodge medical devices, prompting clinicians to anchor these devices more firmly, which increases the risk of pressure injuries. 75% of the PIs occurred on head and trunk and 24% on the extremities. 32% of the pressure injuries were located on the face, 24% on the occiput, 11.3% on the toes.

The most frequent anatomical location of pressure injuries in PICU was reported to be the head and occiput. In a meta-analysis conducted by Zhang et al the body sites affected in the PICU were primarily on the head, with the occiput (23.0%) being the most common area.[4] The high incidence of pressure injuries on the occiput in PICUs might be attributed to anatomical differences.[2,16] As children grow and develop, the location of the highest pressure gradually shifts from the occipital area to the sacral region. This change is likely due to the natural progression of the body's growth and development. Even though the risk factors that cause PIs are well understood, there are still issues with PI prevention. An organized method for PI risk evaluation upon admission and whenever the patient's condition changes is advised by (NPIAP), (EPUAP) and (PPPIA).[10] The Braden Q Scale is a tool specifically designed for assessing the likelihood of pressure injuries (PIs) in children.[16] In 2018, the Braden QD Scale was introduced to expand upon the original Braden Q. It was developed by a team led by Curley et al and included contributions from several other experts.[17] It includes seven subscales: sensory perception, moisture, activity, Nutrition, friction and shear, tissue perfusion and oxygenation. Patients are divided into low-risk and very-high-risk (<9) groups.[19-23] This scale can help identify high risk population and enable health professionals in implementing targeted strategies to prevent PIs.

It was conducted as a pilot project in a newly established PICU with mostly new staff, leading to the absence of a standardized scoring system for assessing pressure injuries, which may have affected accuracy and consistency. Being a single-center study, the findings may not be generalizable to other hospitals with different resources, populations or care facilities. Children with pressure injuries at admission were excluded and their characteristics were not tracked, limiting our understanding of potential differences in risk factors. Additionally, the Braden Q Scale, a validated tool for assessing pressure injury risk in pediatric patients, was not used, meaning the children's risk levels were not formally assessed.

CONCLUSION

In our study we found 4.4% PIs which is lower than previously documented figures. The innovative data collection method, involving daily bedside rounds, enabled the identification of at-risk patients and the prompt implementation of preventive measures. Approximately 60% of the identified pressure injuries were associated with medical devices, raising significant concerns and highlighting the need for ongoing efforts to improve prevention strategies. This includes regular risk assessments and staff education to further decrease the prevalence of PIs in paediatric critical care settings.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rehman F, Panhwer T, Khan NM, Majeed AA, Haque A. Frequency of pressure injuries in a resource limited pediatric intensive care unit of Pakistan: a retrospective study. Int J Contemp Pediatr 2025;12:1619-23.