

CLINICAL SPECTRUM AND OUTCOME OF PATIENTS ADMITTED IN PEDIATRIC INTENSIVE CARE UNIT OF A TERTIARY HOSPITAL

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ABSTRACT

Background: Pediatric Intensive Care Units (PICUs) are crucial for managing critically ill children, yet limited data exist regarding the clinical spectrum and outcomes of patients admitted to PICUs in developing countries, particularly in Pakistan. **Objective:** To assess the clinical spectrum, outcomes, and burden of pediatric patients admitted to the PICU. **Study Design:** A cross-sectional study. **Setting:** The study was conducted at the PICU of The Children's Hospital, Lahore. **Duration of Study:** January to December 2023. **Material and Methods:** A total of 884 patients admitted to the PICU during the study period were included. Patient data, including demographics, diagnoses, clinical interventions, and outcomes, were recorded over one year and analyzed using SPSS version 26. Descriptive statistics were employed, and associations were identified using the Chi-square test, with statistical significance set at $p < 0.05$. **Results:** The mean age of patients was 6.7 years, with 58.8% being male. The most common diagnoses included pneumonia (22.3%), diabetic ketoacidosis (21.9%), and Guillain-Barré syndrome (15.6%). Mechanical ventilation was required in 54.1% of cases. The overall mortality rate was 14.4%, with pneumonia accounting for 44% of deaths. Significant predictors of mortality included sepsis ($p = 0.000$) and mechanical ventilation ($p = 0.000$). Mortality was notably higher among patients under 1 year of age ($p = 0.000$). **Conclusion:** This study underscores the significant burden of respiratory illnesses, diabetic ketoacidosis, and sepsis in the PICU, along with high mortality rates. Enhancing early interventions, optimizing resource allocation, and implementing targeted care protocols are essential to improving outcomes in critically ill pediatric populations in resource-limited settings.

Keywords: Critical Illness, Diabetic Ketoacidosis, Guillain-Barré Syndrome, Mechanical Ventilation, Pediatric Intensive Care Unit, Pneumonia, Sepsis

INTRODUCTION

Intensive care is essential for the management of critically ill patients for better outcomes (1). The Pediatric Intensive Care Unit (PICU) is the part of the hospital that provides this intensive level of care to critically ill children (2, 3). The main goal of PICU is to provide resuscitation, stabilization and reversal of disease process (4). Since the establishment of the first PICU in Goteborg Children's Hospital in Sweden in 1955, PICUs have expanded rapidly worldwide. However, critical care of children remains one of the most challenging and important issues around the world (5).

Pediatric patients in developing countries have poorer prognosis in PICU as compared to developed countries due to certain factors like delayed referral, especially of patients with respiratory failure, sepsis and multiorgan failure. These patients require critical care and urgent need of oxygen therapy, inotropes and mechanical ventilation impacting significantly on outcomes (6). Critically ill pediatric patients admitted to Pediatric Intensive Care Units (PICUs) exhibit a variety of etiologies and outcomes, with respiratory diseases being the leading cause of admission (5,7,8).

Understanding the epidemiology and disease outcomes of patients admitted to PICU may help in developing health policies, dedicated institutional protocols and redistributing resources⁹. Observational data is also crucial for developing new clinical trials and improving patient outcomes (8).

However, there is a significant gap in research on the disease spectrum and outcomes in PICUs of Pakistan. There are very few studies on this subject in the region, and none has been done at the Children's Hospital, Lahore, which has the largest PICU setup in the country. The Children's Hospital is unique in having a wide range of pediatric subspecialties, potentially resulting in a distinct patient population and disease outcomes compared to other settings. Therefore, studying the

clinical spectrum and outcomes in this context may provide valuable insights and inform future healthcare strategies.

To find the disease spectrum and outcomes in children admitted to the PICU at The Children's Hospital, Lahore, over one year.

METHODOLOGY

This retrospective observational study was conducted in the PICU of the University of Child Health Sciences, The Children's Hospital, Lahore, from January to December 2023. Data were collected from patient records using non-probability consecutive sampling. All pediatric patients admitted to the PICU during the study period were included, while those with incomplete medical records or discharged within 24 hours of admission were excluded. Patient demographics, diagnoses, clinical interventions, and outcomes were extracted and analyzed using SPSS version 26. Descriptive statistics were used, and the Chi-square test was applied to identify associations, with a p-value < 0.05 considered statistically significant...

RESULTS

A total of 884 patients were admitted, with a mean age of 6.7 ± 4.27 years (range 1–20 years), and a subset under 12 months had a mean age of 5.7 ± 2.98 months. The mean weight of patients was 16.94 ± 10.42 kg (range 2–65 kg). Monthly admissions peaked in March ($n=102$, 11.5%). The gender distribution was 520 males (58.8%) and 364 females (41.2%). (Table 1)

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Table 1: Demographic Characteristics of PICU Patients

Characteristic	Value
Total Number of Patients	884
Mean Age (years)	6.7 ± 4.27 (range: 1–20 years)
Patients Under 12 Months	Mean age: 5.7 ± 2.98 months
Age Distribution	<1 year: 23.5% (n=208) 1–5 years: 37.4% (n=331) >5 years: 39.1% (n=345)
Gender Distribution	Male: 58.8% (n=520) Female: 41.2% (n=364)
Mean Weight (kg)	16.94 ± 10.42 (range: 2–65 kg)
Monthly Admissions	Peak in March: 11.5% (n=102)

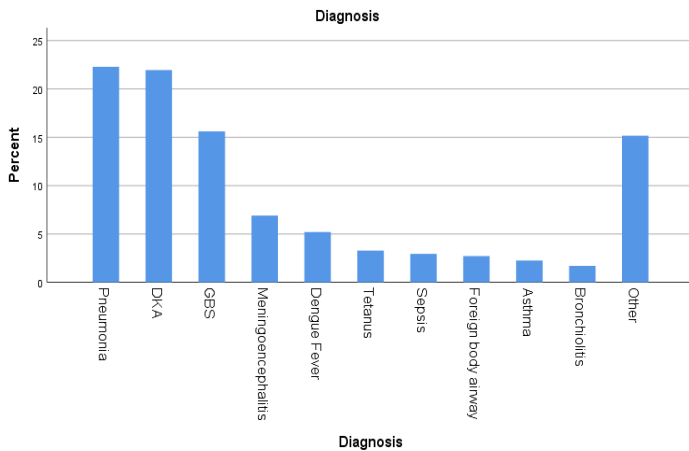


Figure 1: Diagnosis of the study population

Pneumonia (n=197, 22.3%), diabetic ketoacidosis (DKA) (n=194, 21.9%), and Guillain-Barré syndrome (GBS) (n=138, 15.6%) were the most common conditions. Other notable conditions included meningoencephalitis (6.9%, n=61), and dengue fever (5.2%, n=46). Sepsis was noted in 47.6% (n=421) of the patients during their PICU stay, despite only 2.9% (n=26) having sepsis as the initial diagnosis upon admission. Mechanical ventilation was required in 54.1% of cases, with 42.1% managed via non-invasive ventilation. Central venous catheters were used in 7.5%, and 2.9% needed peritoneal dialysis. The average duration of mechanical ventilation was 12.69 ± 15.62 days, and the average PICU stay was 10.52 ± 14.60 days. (Figure 1)

Out of the 884 patients, 127 (14.4%) expired, 157 (17.8%) were discharged, 480 (54.3%) were transferred, 111 (12.6%) left against medical advice (LAMA), 6 (0.7%) were discharged on request (DOR), and 2 (0.2%) absconded. (Figure 2).

Table 2: Mortality in PICU patients by disease spectrum

Condition	Deaths (n)	Percentage of Total Deaths (%)	Mortality Rate (%)
Pneumonia	56	44.0	28.9 (56/197)
Diabetic Ketoacidosis (DKA)	13	10.2	6.7 (13/194)
Meningitis	10	7.8	16.4 (10/61)
Guillain-Barré Syndrome (GBS)	3	2.4	4.7 (3/64)
Tetanus	2	1.2	6.9 (2/29)
Acute Respiratory Distress Syndrome (ARDS) (Diagnosis at admission)	2	1.6	66.7 (2/3)
Sepsis (Diagnosis at admission)	14	10.9	53.8 (14/26)

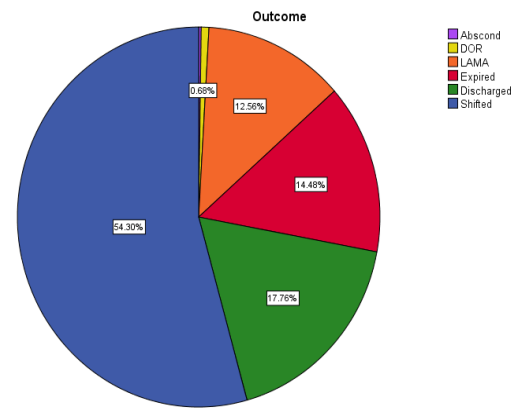


Figure 2: Patient outcome of the study population

Pneumonia accounted for 44% (n=56) of all deaths, with a mortality rate of 28.9% (56/197). Diabetic ketoacidosis (DKA) contributed to 10.2% (n=13) of deaths, with a mortality rate of 6.7% (13/194). Meningitis was responsible for 7.8% (n=10) of deaths, with a mortality rate of 16.4% (10/61), while Guillain-Barré syndrome (GBS) accounted for 2.4% (n=3) of deaths, with a mortality rate of 4.7% (3/64). Tetanus contributed to 1.2% (n=2) of deaths, with a mortality rate of 6.9% (2/29), and acute respiratory distress syndrome (ARDS) contributed to 1.6% (n=2) of deaths, with a mortality rate of 66.7% (2/3). Sepsis as the initial diagnosis accounted for 10.9% (n=14) of deaths, with a mortality rate of 53.8% (14/26). Overall, sepsis was present in 72.7% (n=92) of expired cases. Among the deceased, 34.4% (n=44) were under one year of age, and 60.9% (n=77) were under five years. Additionally, 93.8% (n=119) of those who died had received mechanical ventilation. (Table 2) There was a statistically significant association between mortality and being under 1 year of age (p = 0.000), as 23.5% of infants under 1 year died compared to 12% of older patients. Children under 5 years also had a significantly higher mortality rate (17%) than those 5 years or older (11.6%, p = 0.021). Mortality was significantly higher among patients with sepsis (21.9%, p = 0.000) compared to those without sepsis (7.6%). Mechanical ventilation was strongly associated with mortality (p = 0.000), with a mortality rate of 24.9% for ventilated patients compared to 2% for non-ventilated patients. Non-invasive ventilation was associated with lower mortality (5.6%, p = 0.000). Culture-positive infections, however, were not significantly associated with increased mortality (p = 0.077). (Table 3) Most patients were admitted to the PICU from the emergency department (40.8%), neurology (13.5%), medicine I (11.2%), and medicine II (6.1%). The endocrinology department had the highest number of outgoing transfers (19.2%)

Table 3: Association of Clinical Variables with Mortality in PICU Patients

Clinical Variable	Mortality Rate	p-value
Age < 1 year	23.5% (infants < 1 year) vs. 12% (patients ≥ 1 year)	<0.001
Age < 5 years	17% (children < 5 years) vs. 11.6% (patients ≥ 5 years)	0.021
Sepsis	21.9% (with sepsis) vs. 7.6% (without sepsis)	<0.001
Mechanical Ventilation	24.9% (ventilated) vs. 2% (non-ventilated)	<0.001
Non-Invasive Ventilation	5.6% (patients with non-invasive ventilation)	<0.001
Culture-Positive Infections	Not significantly associated with mortality	0.077

DISCUSSION

The present study offers a detailed investigation of the morbidity and mortality in the PICU of a tertiary care hospital in Pakistan. The mortality rate of 14.4% in the current study is comparable to studies done in regions close to our study area, actually, in India the mortality rate stands at 15.2% though some studies in Bangladesh reported a slightly higher rate at 26.6%. Our results are more favourable than those demonstrated by other works conducted in other areas of the country including Peshawar, where mortality was recorded at about 22%. Mortality of those affected can range from 10-15% in low-middle-income countries, and it is as low as 5-6% in high-income countries – marking high differences between low-resource and high-resource environments (5).

Pneumonia was the commonest reason for admission in our study population with an admission rate of 22.3 % and overall mortality of 28.9 % among admitted patients. Similar studies conducted in Pakistan have revealed a somewhat lower mortality rate for pneumonia like 18 % in a study carried out in Karachi recently. Nevertheless, the presentations in our study might be different due to the severity of the illness and delayed presentations of patients⁷. These results are similar to other LMIC studies, in which pneumonia yet remains an important contributor to morbidity and mortality in PICUs.

We noted increased incidences of Diabetic ketoacidosis (DKA) at 21.9% in admissions to PICU, which is much higher than that reported in other countries. This increase has also been observed in Pakistan and a new trend in type I diabetes in children has led to more cases of DKA admissions (10). The incidence of DKA in this study was comparably high; however, its overall mortality rate of 6.7% was relatively low and similar to recent published nationwide data Local and international studies have reported a rising trend of DKA mortality in recent years (11).

GBS was the most common non-traumatic cause of PICU admission in our study, occurring in 15.6% of patients, which is higher than rates noted in India and other studies performed in Pakistan. Our mortality for GBS (4.7%) was low and comparable to other recently published studies, especially where mechanical ventilation is possible (3.6 – 5.2%) (15).

Sepsis again continues to be a leading cause of mortality in our study whereby an improved number of 47.6% of these patients develop sepsis at some time while within the PICU. Mortality of sepsis cases where sepsis was the primary diagnosis on admission was equally high at 53.8%. Sepsis mortality rates in this study were higher than those reported in developed countries standing between 23-30%¹⁴. Mortality from sepsis is still high in LMICs: the mortality rates evinced in other Pakistani studies (\approx 40%) suggest that this burden persists. Disproportionation can be explained by a lack of immediate diagnostics and treatment of sepsis and inadequate access to interventions in general (16). The low number of ARDS cases may be attributed to underdiagnosis, delayed diagnosis due to late presentation of patients, and misclassification as other respiratory conditions. Improved diagnostic capabilities and earlier detection are essential for better management of ARDS in resource-limited settings.

MV was needed in more than half of the patients (54.1 %), which was

not dissimilar to Bangladesh¹⁷. Nevertheless, our rate of invasive ventilation is higher than in some other Pakistani studies (18). After our study, there was a longer mechanically ventilated length of stay (mean duration of 12.69 ± 15.62 days) than that reported in high-income countries (19).

The study's strengths include a large sample size and comprehensive data from a leading tertiary care PICU. Limitations involve its single-centre design and retrospective nature, which may limit generalizability and introduce potential bias.

CONCLUSION

The study underscores the significant burden of respiratory illnesses, diabetic ketoacidosis, and sepsis in the PICU, which are associated with high mortality, particularly in infants and ventilated patients. These findings highlight the urgent need for improved early detection, timely interventions, and optimized care strategies to reduce mortality. The results call for better resource allocation and tailored protocols to address the critical care challenges in resource-limited settings, ultimately improving pediatric outcomes.

DECLARATIONS

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-UCH-093/23)

Consent for publication

Approved

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CONFLICT OF INTEREST

The authors declared the absence of a conflict of interest.

AUTHOR CONTRIBUTION

ABDUL REHMAN (Fellow)

Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.

MUHAMMAD SARWAR (Head of Department, Associate Professor)

Study Design, Review of Literature.

MOMINA KHAN (Fellow)

Conception of Study, Final approval of manuscript.

NIGHAT SULTANA (Associate Professor)

Manuscript revisions, critical input.

MAHNAZ PARVEEN (Fellow)*Data entry and Data analysis, drafting article.***AMBREEN ASLAM** (Fellow)*Coordination of collaborative efforts.*

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