

# Clinical Spectrum and Epidemiological Profile of Patients Admitted to Pediatric Intensive Care Unit at a Tertiary Care Centre in South India

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## Abstract

**Introduction:** The knowledge of clinical spectrum and epidemiological profile of critically ill children plays a significant role in the planning of health policies that would mitigate various factors related to the evolution of diseases prevalent in these sectors. The data collected enable prospective comparisons to be made with benchmark standards including regional and international units for the continuous pursuit of providing essential health care and improving the quality of patient care.

**Purpose:** To study the clinical spectrum and epidemiological profile of the critically ill children admitted to the pediatric intensive care unit at a tertiary care center in South India.

**Materials and Methods:** Descriptive data were collected retrospectively from the Hospital medical records between 2013 and 2016.

**Results:** A total of 1833 patients were analyzed during the 3-year period, of which 1166 (63.6%) were males and 667 (36.4%) were females. A mean duration of stay in pediatric intensive care unit (PICU) was  $2.21 \pm 1.90$  days. Respiratory system was the most common system affected in our study 738 (40.2 %). Acute poisoning in children constituted 99 patients (5.4%). We observed a mortality rate of 1.96%, with no association with age or sex. The mortality rate was highest in infants below 1-year of age (50%). In our study, the leading systemic cause for both admission and death was the respiratory system.

**Conclusion:** This study analyses the epidemiological pattern of patients admitted to PICU in South India. We would also like to emphasize on public health prevention strategies and community health education which needs to be reinforced, especially in remote places and in rural India. This, in turn, would help in decreasing the cases of unknown bites, scorpion sting, poisoning and arthropod-borne illnesses, which are more prevalent in this part of the country.

**Key words:** Child, Female, India/epidemiology, Infant, Intensive care units, Male, Patient admission, Pediatrics, Retrospective study

## INTRODUCTION

The care of critically ill children remains the most demanding and significant aspect in the field of pediatrics. Optimum care in the pediatric critical care unit depends on the level of training and expertise of the health-care

personnel, the availability of the resources, and evidence-based management protocols. The principal objective of pediatric critical care is not only to decrease the mortality but also to restore the child who is suffering from a life-threatening condition to health with a minimum of pain, anxiety, and complications and to provide comfort and guidance to the child's family.<sup>1</sup>

In spite of the modern health-care facilities and several health programs rolled out by the governments and policy makers every year, the current global situation of the under-five mortality rate is alarming. About 5.9 million children under age five died in 2015,<sup>2</sup> i.e., 16,000 every day. These are the figures given by global health observatory data, WHO.

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Among the postneonatal deaths (1-59 months), pneumonia constituted 13%, diarrhea 9%, and malaria 5%.

By providing basic pediatric intensive care services such as intravenous access and fluid resuscitation, basic antibiotic support, oxygen and non-invasive ventilator support (continuous positive airway pressure) one can save the lives of million children every year in rural areas of developing countries. The main goal of pediatric intensive care unit (PICU) is to significantly decrease the mortality. These interventions are low cost and easy to implement in developing countries on a large scale to decrease mortality. The acquisition of technologies, training of human resources, and re-evaluation of care processes should be employed according to the demographic characteristics and morbidity of the population.

The knowledge of clinical spectrum and epidemiological profile of critically ill children plays a significant role in the planning of health policies that would mitigate various factors related to the evolution of diseases prevalent in these sectors. Descriptive epidemiology focuses on identifying and reporting the pattern and frequency of events related to the health of a population.<sup>3</sup> This process also determines the general characteristics of disease under study and identifies the most vulnerable population subgroups.

Observational data guide the design of new protocols and clinical trials, which in turn helps in disease management and reduction of mortality. Regional disparities in the availability of resources, the quality of pediatric critical care services play a major role in the outcome of critically ill children. The data thus collected enable prospective comparisons to be made with benchmark standards and similar health-care units, including regional and international units, as well as within the same unit, for the continuous pursuit of providing essential health care and improving the quality of patient care.

With that, we set out to study the clinical profile of children admitted to pediatric critical care unit. The objective of this study was to report the clinical spectrum, epidemiological profile, and outcomes of critically ill children admitted to a pediatric critical care unit at a tertiary care center in South India.

## MATERIALS AND METHODS

This retrospective study reviewed the admissions into the PICU of Sri Manakula Vinayagar Medical College and Hospital a tertiary care center in Puducherry, India, from March 2013 to April 2016. The hospital is a residency

training center that offers a concurrent educational program for residents in general pediatrics. The hospital operates a well-equipped six bed modern PICU, which admits pediatric patients  $\leq 14$  years of age, from both medical and surgical subspecialties. An assistance is provided by a multidisciplinary team of pediatric critical care physicians, nurses and nursing technicians, physical therapists, social workers, psychologists, dieticians, speech therapists, and doctors specialized in the field of pediatrics.

Ethical approval was waived by the Ethics Committee of the hospital as this is a retrospective observational study.

PICU records of all admissions, transfers out, discharges, and deaths were utilized for the purpose of this study. Our PICU admissions included patients who are critically ill but recoverable who need care other than that available in the general wards and post-surgical patients needing critical care. The following variables were included for analysis: Operating capacity (occupancy rate and number of beds), age, gender, reason for hospitalization (clinical, surgical or emergency), length of stay, and diagnosis. Outcome is classified as transfers to the main pediatric wards, discharges, discharges against medical advice, and death. For age analysis, we adopted the following stratification:  $< 1$  year, 1-5 years, 5-10 years, and  $> 10$  years. The analysis of the data was performed using Microsoft Office Excel version 2007 and statistical package for social science, version 17.0. Nominal data were compared using the  $\chi^2$  tests.  $P < 0.05$  was considered significant.

## RESULTS

Our PICU consists of 6 beds, A total of 1833 patients were analyzed during the 3-year period, of which 1166 (63.6%) were males and 667 (36.4%) were females, giving a male:female ratio of 1.74:1. Of the total patients admitted 921 (50.2%) were infants, patients aged 1-5 years were 508 (27.7%), age group of 5-10 years constituted 254 (13.9%), and patients aged  $> 10$  years to  $\leq 14$  years were 150 (8.2%). Table 1 elaborates the sex and age wise distribution of cases admitted in PICU. An average age of the patients admitted was  $3.31 \pm 3.69$  years. The average age for males was  $3.13 \pm 3.60$  and that for females was  $3.61 \pm 3.60$ . The mean duration of stay in PICU was  $2.21 \pm 1.90$  days ranging from 1 to 16 days. Table 2 shows the duration of stay in PICU.

Respiratory system was the most common system affected in our study 738 (40.2 %). Pneumonia was the most common diagnosis for patients with respiratory diseases. The three most common respiratory causes for hospitalization included bronchopneumonia, bronchiolitis, and hyperactive airway

disease. Infectious diseases constituted the next major chunk of cases that were admitted to our PICU 358 (19.5%). Infectious diseases majorly consisted of scrub typhus, sick dengue, complicated enteric fever, and malaria. It also included two cases each of staphylococcal scalded skin syndrome and Steven Johnson syndrome. The other major system involved in our study was central nervous system, 293 (15.9%). Febrile seizure, seizure disorder, and meningitis constituted most of the central nervous system (CNS) cases. Neurocysticercosis constituted a few cases of CNS.

Acute poisoning in children constituted 99 patients (5.4%) of all pediatric emergency admissions. It mainly consisted of accidental ingestion of household products and insecticides. Miscellaneous in Table 2 includes diabetic ketoacidosis, malignancy, electrocution, scorpion sting and unknown bites. It consisted of 71 (3.87%) cases. Table 3 highlights the number of patients admitted with major system involvement in different age groups.

Regarding the clinical outcome, 1647 (89.85%) patients improved, were transferred to the pediatric, and were eventually discharged; 36 (1.96%) patients died; 150 (8.18%) left against medical advice. We observed a mortality rate of 1.96%, with no association with age or sex. The average and median ages of the deceased patients were  $2.92 \pm 3.16$  standard deviation (SD) and 1.5 years, respectively; males

had an average age of  $2.91 \pm 3.45$  SD and females had an average age of  $2.93 \pm 2.87$  SD. Tables 4 and 5 elaborate the number of mortality in various age groups and systems, respectively. The average length of stay (LOS) for the deceased patients was  $3.33 \pm 2.85$  days. A mortality rate was highest in infants below 1-year of age (50%). In our study, the leading systemic cause for both admission and death was the respiratory system.

## DISCUSSION

This study revealed that respiratory, infectious diseases and neurological diseases were the major causes of admission to the PICU of the tertiary care center studied. It was similar to that reported by Lanetzki *et al.*,<sup>3</sup> also respiratory diseases were the most common reason for hospitalization among patients in PICC at HIAE reported by Draper *et al.*<sup>4</sup> However, cardiovascular disease entity as the most common (41.1%) cause of admission to PICU was reported by Abhulimhen-Iyoha *et al.*<sup>5</sup> The less number of patients admitted with cardiovascular complaints is justified by the fact that we lack a full-fledged cardiovascular and cardiothoracic surgery unit in our center.

Children less than 1-year of age were the most vulnerable group, who presented to the emergency department

**Table 1: Sex and age wise distribution of the study group**

Age	<1 year	>1 to <5 years	>5 to <10 years	>10 to <14 years	Total
Male	608	318	154	86	1166 (63.6)
Female	313	190	100	64	667 (36.4)
Total (%)	921 (50.2)	508 (27.7)	254 (13.9)	150 (8.2)	1833

**Table 2: Duration of stay in the PICU**

Duration of stay (days)	<1 year	>1 to <5 years	>5 to <10 years	>10 to <14 years	Total (%)
1	480	286	130	83	979 (53.4)
2-5	374	195	107	60	736 (40.2)
6-10	58	24	16	6	104 (5.7)
>10	9	3	1	1	14 (0.8)

PICU: Pediatric intensive care unit

**Table 3: System wise distribution of the patients admitted in PICU**

System	≤1 year	>1 to ≤5 years	>5 to ≤10 years	>10 to ≤14 years	Total (%)
Respiratory	506	128	69	35	738 (40.2)
Infections	144	99	64	51	358 (19.5)
CNS	118	121	36	18	293 (16)
GIT	72	62	32	15	181 (9.9)
Genitourinary	8	15	28	11	62 (3.4)
Poisoning	32	50	12	5	99 (5.4)
Surgery	11	7	1	7	26 (1.4)
Orthopedics	4	1	0	0	5 (0.3)
Miscellaneous	26	25	12	8	71 (3.9)

GIT: Gastrointestinal tract, CNS: Central nervous system

**Table 4: Sex and age wise distribution of the deceased cases**

Age	≤1 year	>1 to ≤5 years	>5 to ≤10 years	>10 to ≤14 years	Total
Male	10	6	3	1	20
Female	8	5	3	0	16
Total	18	11	6	1	36

**Table 5: System wise distribution of the deceased cases**

System	≤1 year	>1 to ≤5 years	>5 to ≤10 years	>10 to ≤14 years	Total (%)
Respiratory	14	6	0	0	20 (55.55)
GIT	2	2	1	0	5 (13.8)
Infections	1	2	3	0	6 (16.6)
CNS	0	1	1	1	3 (8.3)
Genitourinary	1	0	1	0	2 (5.55)
Total	18	11	6	1	36

GIT: Gastrointestinal tract, CNS: Central nervous system

requiring admission to the PICU 921 (50.2%), this was similar to that reported by Rady,<sup>6</sup> Einloft *et al.*<sup>7</sup> (40%), and Lanetzki *et al.*<sup>3</sup> In our study, males constituted 63% of admission (1166), it was similar to that reported by Batista *et al.*<sup>8</sup> (56%) and Einloft *et al.*<sup>7</sup> (58%).

In this study, the mean duration of stay in PICU was found to be  $2.21 \pm 1.90$  days. In a study conducted in Brazil by Batista *et al.*,<sup>8</sup> LOS in PICU was  $6.9 \pm 5.5$  days, whereas in a study conducted in Israel by Lanetzki *et al.*<sup>3</sup> LOS was 9.7 days. Although some studies reveal that there is correlation between LOS and outcome of pediatric patients,<sup>9</sup> others show no relationship.<sup>10</sup> In this study, there was no significant relationship between LOS and outcome as was documented by Patil<sup>10</sup> in the year 2012.

In contrast to the general and polytrauma cases reported by Abhulimhen-Iyoha *et al.*<sup>5</sup> and Batista *et al.*,<sup>8</sup> we hardly had any cases of trauma. Furthermore, in contrast to Lanetzki *et al.*<sup>3</sup> Abhulimhen-Iyoha *et al.*<sup>5</sup> and Batista *et al.*,<sup>8</sup> we had a significant number of cases of poisoning 99 (5.4%), scorpion sting and unknown bites. The above findings in our study could be attributed to the fact that the majority of the patients the center caters to belong to rural population and remote places of South India.

We found that the mortality was the highest below 1-year of age (50%) and it was similar to that reported by Rady<sup>6</sup> (43.9%) and Batista *et al.*<sup>8</sup> (44.7%). The observed mortality rate in our study was low (1.96%). This observation was in contrast to that reported by Abebe *et al.*<sup>11</sup> (40%) and Batista *et al.*<sup>8</sup> (15.6%). We found that our observations were comparable to the mortality reported by a study in Israel, Lanetzki *et al.*<sup>3</sup> (1.87%) and in India, Abhulimhen-Iyoha *et al.*<sup>5</sup> (2.1%). Important factors that may have contributed to survival in these patients include adequate manpower, equipment, and provision

of continuous medical education in pediatric critical care from time to time for staff by the institution.

Some patients remained in the unit for as long as 16 days either because they required critical care for the period or for logistic reasons, i.e., lack of a step-down ICU or no bed space at main pediatric wards to enable their transfer. Because of the lack of a step-down unit in our center, many of the patients who although were not critically ill but still required some monitoring were admitted in PICU. This resulted in full recovery of some patients in PICU resulting in their discharge home directly from the ICU. This, in turn, resulted in an improper use of the resources and added the burden on the caregivers in the ICU.

## CONCLUSION

This study analyses the epidemiological pattern of patients admitted to PICU in South India. This can serve as the basis for developing dedicated and new protocols for the caregivers in an effort to improve the outcome of critical illness. It would also enhance the cost effectiveness.

The study also stresses on the need for a step-down unit and redistribution of resources to cater for the needs of patients not ill enough to require ICU admission. This not only reduces the burden on the intensive care personnel but also significantly reduces the economic burden on the patients.

We would also like to emphasize on public health prevention strategies and community health education which needs to be reinforced, especially in remote places and in rural India. This, in turn, would help in decreasing the cases of unknown bites, scorpion sting, poisoning and arthropod-borne illnesses, which are more prevalent in this part of the country.

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