

## DISEASE PROFILE AND OUTCOME OF PATIENTS ADMITTED TO A PEDIATRIC INTENSIVE CARE UNIT

Sanat Kumar Barua<sup>1\*</sup> Kiriti Prashad Deb<sup>1</sup> Arup Dutta<sup>2</sup> Nasir Uddin Mahmud<sup>3</sup>  
Pranab Kumar Chowdhury<sup>3</sup> Sharmila Barua<sup>4</sup>

### Abstract

**Background:** Pediatric Intensive Care Unit (PICU) has very important role in the management of critically ill children who require advanced airway, respiratory, and hemodynamic supports with the aim of achieving a better outcome. To describe the clinical spectrum and outcome patterns of diseases managed at PICU in Chittagong Medical College Hospital (CMCH) in order to provide data, which will assist in improving the management of diseases and the rational allocation of health resources. **Materials and methods:** It was a retrospective cross-sectional study in which records of admissions of children from 29 days to 12 years of age were obtained from the PICU records. **Results:** A total of 851 patients were analyzed during the period of October 2015 to December 2016, of which 533 (62.6%) were males and 318 (37.3%) were females. The mean duration of hospital stay was 5.2 ±2.1 days (Range 0- 20 days). Among admission cases, Central Nervous System (CNS) was the most common system affected in our study 356 (41%) followed by respiratory system 263(31%) sepsis 89(10.45%) and cardiovascular diseases 55(%). We observed overall mortality rate 46.1%and Leave Against Medical Advice (LAMA) 4.11%. Highest mortality occurred in age group of 29 days to 1 year. Children with encephalitis and sepsis had higher mortality 25% and 21% respectively. **Conclusion:** The leading cause

of admission was CNS infection followed by respiratory diseases and sepsis. The overall mortality rate in our PICU was high. A well-equipped intensive care unit with modern and innovative facilities along with the availability of fulltime trained pediatric intensivists made a significant impact on the outcome of critically ill children in our PICU.

### Key words

Clinical profile; Mortality; Children; PICU.

### Introduction

Pediatric Intensive Care Unit (PICU) is an important component of any tertiary care hospital and has got a very important role in management of critically ill children. The patient who requires respiratory support, advanced airway management, hemodynamic support, and continuous monitoring are admitted in PICU for better outcome<sup>1</sup>. The main purpose of the PICU is to reduce mortality by treating and intensively monitoring critically ill children<sup>2</sup>. This can be achieved by well-equipped and well-staffed intensive care unit<sup>3-6</sup>.

Mortality of patients depends on many factors such as demographic variables, clinical characteristic and co-morbidities, infrastructure and availability of adequate staff<sup>7</sup>. The documenting disease profile and outcome of PICU differ in different studies from western countries but very few such studies are available from the developing countries<sup>8</sup>.

Child mortality is a sensitive basic indicator of a country's development and evidence of its priorities and values. According to UNICEF-2017 world's under five mortality rank of Bangladesh is 62 and mortality rate is 34/1000 live birth, it is higher in rural than urban per 1000 live birth<sup>9</sup>. A few reports have described current status regarding a variety of clinical conditions and outcome of PICU in Bangladesh. Two years analysis of patients admitted in PICU at Dhaka shishu hospital showed that serious bacterial infections, GBS and congenital heart disease were the major causes of admission and the major causes of death were septicemia and pneumonia<sup>10</sup>.

1. Associate Professor of Pediatric Nephrology  
Chittagong Medical College, Chittagong.
2. Associate Professor of Pediatrics  
Chittagong Medical College, Chittagong.
3. Professor of Pediatrics  
Chittagong Medical College, Chittagong.
4. Medical Officer of Radiology and Imaging  
Chittagong Medical College Hospital, Chittagong.

**\*Correspondence:** Dr. Sanat Kumar Barua

E-mail: sanat.barua@yahoo.com  
Cell : 01819 819106

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Improving outcome is possible by well-equipped and well-staffed intensive care units, because it decreases the mortality and morbidity rates by 15% to 60% respectively<sup>11</sup>.

With the advancement in intensive care facilities, there is a dramatic increase in survival of critically ill children<sup>3,11</sup>. PICU is a relatively new field in Bangladesh. There are few PICU in Bangladesh and most of them are located in the capital city of Dhaka. There is a lack of trained professionals, resources and research in this emergency field. Moreover besides, there is no organized database concerning children admitted to critical care and their mortality pattern in Bangladesh. That's why we, therefore, analyzed the data of our PICU to find out the pattern of disease and outcome at our centre. This would allow identifying the magnitude and pattern of each illness that needs intensive care admission, better management of critically ill children and redistribution of resources as well as assess the existing services and further improving the existing facilities for optimum patient care.

#### Materials and methods

This is a retrospective cross-sectional study performed in 29 days to 12 years aged children admitted in PICU, CMCH, using data collected from medical records. This hospital is located in Chittagong town, south-east region of Bangladesh. It is the only specialized tertiary teaching hospital in this region, with 1500 beds and 550 health professionals, where a multidisciplinary team of diverse professionals provide a range of health care services. In the year of 2017, patients admitted to the Pediatric Department and Special Care Neonatal Unit were 17,034 & 11,202 respectively<sup>12</sup>. Our 10 bedded PICU was established in 29<sup>th</sup> October 2015 and contains 6 ventilators, syringe pump, portable ultrasonograph and monitors. Critically ill children are managed by postgraduate doctors, nursing staffs and supervised by junior consultants and professors of general pediatrics, but no intensivist is present.

PICU records of all admissions, transfers out, discharges, and deaths were utilized for the purpose of this study. The following variables were included for analysis: age, gender, reason for hospitalization, length of stay, diagnosis and outcome. This outcome is classified as satisfactory discharges, Leave Against Medical

Advice (LAMA) transfers to the higher centre, and death. For age analysis, we adopted the following stratification: 29days to 12 month, 1-5 years, and >5-12 years. The analysis of the data was performed using Microsoft Office Excel version 2007 and data were recorded as median, number, frequency and percentages.

Ethical approval was waived by the Ethical Committee of Chittagong Medical College as this is a retrospective observational study.

#### Results

**Table I :** Age & sex wise distribution of admission and death

Age	Male (%)	Female (%)	Total (%)	Death (%)
29 days to 12 Month	339 (39.9%)	185 (21.7%)	524 (61.57%)	251 (63.86%)
1 to 5 Year	117 (13.7%)	73 (8.5%)	190 (22.3%)	72 (18.3)
>5 to -12 Year	77 (9%)	60 (7.1%)	137 (16.1%)	70 (17.8%)
	533 (62.6%)	318 (37.3%)	851 (100%)	393 (100%)

**Table II :** Distribution and outcome in relation to systems involved

System involved	Total n (%)	Improved n (%)	Expired n (%)	LAMA n (%)	Referral n (%)
Central nervous system	356 (41%)	195(46.3%)	145 (36.9%)	15(4.2%)	01 (0.28%)
Respiratory System	263 (31%)	154(36.6%)	101(25.7%)	8(3%)	00 (00%)
Cardiovascular system	55 (6%)	13 (3.1)	35 (8.9%)	6(11%)	01 (1.8%)
Renal	27 (3%)	18 (4.3%)	8 (2%)	1(3.7%)	00 (00%)
Gastrointestinal system	23 (2%)	8 (1.9%)	14(3.6%)	1(4.3%)	00 (00%)
Sepsis	89 (10.45%)	4 (0.95%)	83 (21.1%)	2(2.2%)	00 (00%)
Hematological	08 (0.9%)	(0.47%)	5(1.1%)	1(12.5%)	00 (00%)
Poisoning	04 (0.47%)	(0.95%)	00	00	00 (00%)
Surgical	09 (1.05%)	(2.1%)	00	00	00 (00%)
Endocrine	11(1.3%)	10 (2.37%)	01 (0.25%)	00	00 (00%)
Other	06 (0.7%)	04(0.95%)	01(0.25%)	01(16.7%)	00 (00%)
Total	851	421	393	35	02

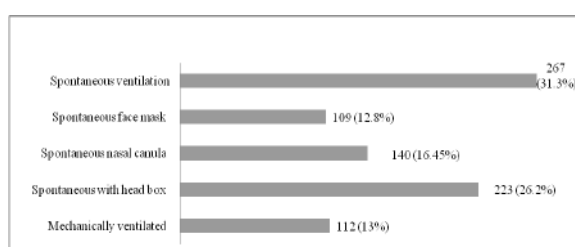
**Table III :** Common diseases and mortality of admitted children

Diseases	Number of admission (%)	Number of death (%)
Encephalitis	213 (25%)	99 (25%)
Meningitis	83 (9.8%)	28 (7%)
CP with seizure disorder with developmental delay	17 (2%)	08 (2%)
GBS	09 (1%)	03 (0.7%)
Hydrocephalous with shunt surgery with complications	02 (0.2%)	02(0.5%)
CNS tumor	03 (0.4%)	02 (0.5%)

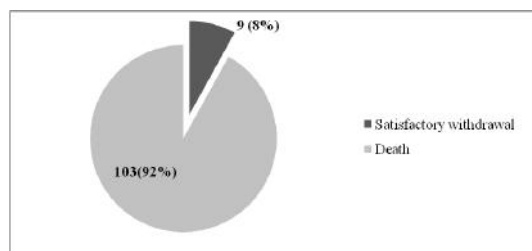
ADEM	03 (0.4%)	03 (0.7%)
Sepsis	89 (10.4%)	83 (21%)
Bronchopneumonia	168 (19.7%)	86 (21.9%)
Bronchiolitis	39 (4.5%)	15 (3.8%)
Severe acute bronchial asthma	22 (2.6%)	00(0.0%)
VSD with bronchopneumonia	17 (2%)	16 (4.1%)
CHD	36 (4.2%)	19 (4.8%)
SAM with complications	10 (1.2%)	08 (02%)
Hepatic encephalopathy	06 (0.7%)	04 (0.7%)
Neonatal hepatitis syndrome	02 (0.2%)	00(0.0%)
CLD	01 (0.12%)	00(0.0%)
AWD with electrolyte imbalance	02 (0.2%)	00(0.0%)
Severe malaria	02(0.2%)	00(0.0%)
Drowning	05 (0.59%)	02 (0.5%)
Nephrotic syndrome with complications	07 (0.8%)	04 (01%)
AKI	02(0.2%)	02 (0.5%)
CKD	04 (0.47%)	02 (0.5%)
Acute leukemia	04(0.47%)	04 (01%)
Surgical cases	09 (1.05%)	00(0.0%)
Kerosene poisoning	05 (0.59%)	00(0.0%)
Miscellaneous	91(10.7%)	03 (0.7%)

**Table IV :** Length of hospital stay and outcome of admitted patient

Day	No of Patients	No. of satisfactory discharge	No. of LAMA	No. of Referred to the higher center	Death n (%)
<1 Day	851	00	02	01	124 (31.5%)
1-2 days	724	00	02	00	99 (25.2%)
2-7 days	623	78	11	00	63 (16%)
7-14 days	471	121	15	00	58 (14.7%)
>14 days	277	222	05	1	49 (12.4%)
		421 (49.47%)	35 (4.11%)	2 (0.23%)	393 (46.1%)



**Fig 1 :** Bar diagram showing breathing characteristics of the studied patients (n=851)



**Fig 2 :** Pie chart showing outcome of mechanical ventilated patients (n= 112)

A total of 851 patients were analyzed during the study period. Table -1 elaborated the number of admission and mortality with various age & sex. A greater share was taken by the male children 533 (62.6%), with male to female ratio of 1.67:1 and the maximum number of patients belonged to the age group of 29 days to 12 month (61.57 %) followed by age group 1 to 5 years (22.3%). The mortality rate also highest in infants below 1 year of age (63.86%). The Mean duration of hospital stay was  $5.2 \pm 2.1$  days (Range, 0- 20 days).

In table II showed different systems involvement and outcomes of admitted patients. Central nervous diseases 356(41%) respiratory diseases 263(31%) and sepsis 89 (10.45%) were the mostly involved systems and most death occurred from central nervous system 145(36.9%) followed by respiratory system 101 (25.7%) and sepsis 83(21.1%).

Common diseases and mortality of admitted children are tabulated in table III. Among 851 admitted cases in PICU, encephalitis was the leading disease 213 (25%) followed by bronchopneumonia 168 (19.7%) and sepsis 89 (10.4%). Most common CNS diseases were encephalitis 213(25%), meningitis 83(9.8%) and cerebral palsy 17(2.0%). Three most common respiratory causes for hospitalization included bronchopneumonia 168 (19.7%), bronchiolitis 39 (4.5%) and severe acute bronchial asthma 22(2.6%). Miscellaneous 91(10.7%) includes diabetic Ketoacidosis, electrocutions, acute post-streptococcal glomerulonephritis, head injuries. Among 393 deaths, 25% died from encephalitis followed by bronchopneumonia (21.9%) and sepsis (21%).

Table IV showed length of hospital stay and outcome of admitted patients. During hospital stay about one third (31.5%) death occurs within 24 hours of admission and two hundred seventy seven patient stay more than 14 days. Among total 851 patients, 421 (49.47%) patients improved, 393(46.1%) expired and 35 (4.11%) patients leave against medical advice.

Of the 851 patients admitted to the PICU, 112 (13%) were mechanically ventilated from initial admission to discharge or death. The percentage of patients' spontaneous breathing with head box was 223 (26.2%) with nasal canula 140(16.45%) with face mask 109(12.8%) and about one third of patients (31.37%) without any ventilatory assistance (Fig-1). Among 112 mechanical ventilated patients, 8% patients were survived (Fig-2).

### Discussion

The PICU is a part of the hospital where critically ill patients require advanced airway, respiratory, and hemodynamic supports for a better outcome<sup>13</sup>. It plays a vital role in the good quality of health care system and important rules on reduction of childhood mortality in developing countries<sup>14</sup>. However, this component of the health care system, like emergency and critical care are not well organized in our country. Still, lives of many children can be saved by judicious use of available facilities like oxygen, fluids, antibiotics and careful goal-oriented monitoring of patients. The challenge is related to scarcity of equipments, trained human resources, infrastructures, financial resources and malfunction of the systems for caring of the critically ill children<sup>15</sup>.

During 15 months study period, we analyzed 851 patients. Male babies 62.6% outnumbered their female counterpart 37.3% with the ratio of 1.67:1, a finding similar to that of other studies<sup>7,16</sup>. In this analysis, about two thirds (61.57%) patients were 29 days to 12 months age group. This finding was consistent with Hoque et al (65.5%) in Bangladesh, and different studies by other authors of India<sup>2,7,10,17</sup> showed infants were the bulk of admission ranging from 47.4-52.3%. Under 5 years aged children constituted 714 (84%) cases in our study. This finding is almost similar to study conducted by Das et al in India 80.38% and EI Halal MG et al from Brazil 78.38%<sup>17-18</sup>.

In this study, diseases of the central nervous system (Encephalitis, meningitis) respiratory system diseases (Bronchopneumonia, bronchiolitis) and sepsis were the major etiologies in patients with ICU admission. The result is similar to previous study in which CNS was the major cause, but is not comparable with other studies in which the major etiologies were diseases of the respiratory system and sepsis<sup>7,9,17,19-21</sup>. It reflects that admissions in pediatric intensive care unit are vary in different countries within same region and one should be aware of the prevalent conditions to develop the facilities and prepare treatment protocols accordingly.

Overall mortality in our study was 46.1%. The reported mortality varied from 2.1-35% in different series by other authors<sup>20-24</sup>. But in Ethiopia, Abebe et al showed that mortality was 40%<sup>25</sup>.

We postulated that probable reasons of high mortality rate observed by us could be due to delayed referral from peripheral hospitals, inadequate staffing and not enough experience in PICU, less health seeking behavior of parents, and late arrival with multiple complications. Another contributory factor for high mortality in the present series due to large number of encephalitis patient constituted most of the Acute Encephalitis Syndrome (AES) cases which has high mortality (25%). The mortality rate of encephalitis patients in CMCH, 2009 and 2010 were 46% and 56% respectively which was gradually declined to 25% due to better PICU services<sup>26</sup>. Pearson et al have suggested that the availability of full time trained pediatric intensivist can deliver high quality care with much higher efficiency than general pediatrician<sup>27</sup>.

In our study LAMA was 4.11%. But Kalaraiya et al showed LAMA was 14.8%<sup>28</sup>. This finding is not consistent with our study. Probable reasons of low LAMA in our study are due to scarcity of PICU support and high expenditure outside the hospital.

We observed that out of total 393 deaths, 31.5% died within 24 hours of admission, which is in consistent with other study<sup>28</sup>. But in contrary with study done by Shashikala et al they reported 16% deaths occurring within 24 hours of admission<sup>29</sup>. This may be due to admission of more infants and multiple complications. As our PICU has the facility of ventilation only for children more than 5 Kg, lower weight child could not managed by ventilator. In present study, we observed that 82.1% deaths belonged to patients 1 month to 5 years age group, which is in accordance with various studies (72-80%)<sup>28</sup>.

We found that in our study neurological diseases were the most common causes of mortality (36.9%) followed by respiratory diseases (25.7%) and sepsis (21.1%). This observation is consistent with the other studies by Volakli et al, and kalraiya et al but contrary to Kapil et al which reported sepsis as most common cause of death followed by congenital heart disease<sup>30,28,22</sup>. Shah and colleagues in their study in Nepal found respiratory conditions (25%) as most common cause of death in their PICU followed by sepsis (17.24%).

Of the total number of patients admitted, the proportions of patients mechanically ventilated was 13%, which is not consistent with the other

studies (32-37%)<sup>25,31</sup>. This might be due to fact that our ventilators are not supporting the patient below 5 kg, lack of intensivists and paucity of other supports.

### Limitations

This study has few limitations. Retrospective, single-center, unable to assess the severity scoring and incidence of nosocomial infections in our study due to incomplete medical records were the few obvious limitations.

### Contribution of authors

SKB - Conception, acquisition of data, critical revision and final approval.

KPD - Desing, drafting and final approval.

AD - Acquisition of data, analysis, critical revision and final approval.

NUM - Design, drafting and final approval.

PKC - Interpretation of data, analysis, Critical revision and final approval.

SB - Interpretation of data, drafting and final approval.

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### Conclusion

It was concluded that the demographic profile of patients including age, sex, source of admission follow a varied pattern in different PICU patients worldwide. The leading cause of admission was CNS diseases followed by respiratory diseases and sepsis. Our observed mortality rate was high. A well-equipped intensive care unit with modern and innovative facilities along with the availability of fulltime trained pediatric intensivists made a significant impact on the outcome of critically ill children in our PICU.

### Discloser

All the authors declared no competing interest.

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