



ORIGINAL RESEARCH PAPER

Paediatrics

MORTALITY PROFILE AND ITS CORRELATION WITH BPEWS SCORE IN PEDIATRIC INTENSIVE CARE UNIT OF TERTIARY CARE CENTRE

KEY WORDS: PICU, Mortality profile, BPEWS score

Anupama Mauskar*

Professor - Department of Pediatrics, HBT Medical College & Dr R. N. Cooper Hospital*Corresponding Author

Shaikh Khadija Tabshir

Senior Resident - Department of Pediatrics, HBT Medical College & Dr R. N. Cooper Hospital

Nusrat Inamdar

Associate Professor -Department of Pediatrics, HBT Medical College & Dr R. N. Cooper Hospital

ABSTRACT

Introduction: The care of critically ill children remains one of the most demanding and challenging aspects in the field of Pediatrics. In spite of availability of well-equipped Pediatric Intensive Care Units (PICU), deaths do occur. **Aims/objective:** To study the mortality profiles and its correlation to the Bedside Pediatric Early Warning System Score (BPEWS) in children who expired within 48 hours of admission. Inclusion criteria: children aged 1 month to 12 years who expired within 48 hours of admission in PICU of a tertiary care center. **Methods:** Approval from the institutional ethics committee was obtained prior to commencement of the study. Retrospective data of consecutive children aged 1 month to 12 years who expired within 48 hours, was collected from the hospital's Medical Records Section. The variables necessary for BPEWS Score calculator were noted and the BPEWS Score was calculated. **Result:** 84% patients were below five years of age with mean age of 2.6 year and 57% were females. Mean duration of stay was 19.68 hours. Mean distance from health facility was 8.31 km. Respiratory system was affected in the majority of patients (47%). More than forty percent of children were undernourished. Mean BPEWS score was 17.36 in the age group of 1 to 5 year, which depicts poor outcome. **Conclusion:** Majority of early deaths (within 48hrs) occurred in patients less than five years of age. Higher BPEWS (>8) was associated with shorter duration of stay of patients and poor outcome.

Introduction:

The care of critically ill children remains one of the most demanding and challenging aspects in the field of Pediatrics [1]. With advancement in intensive care facilities, there is a dramatic increase in survival of critically ill children. A well-equipped intensive care unit with modern and innovative intensive care greatly facilitates the care of critically ill patients and gives desirable outcome [2].

Although mortality do occur which depends on many factors such as demographic and clinical characteristic of population, infrastructure and non-medical factors (management and organization), case mix, and delayed admission, it is also affected by ICU performance [3].

A variety of Pediatric Early Warning Systems (PEWS) have been proposed. The Bedside Pediatric Early Warning System (Bedside PEWS) by Parshuram C S et al. 2009 [4] is a documentation-based system of care composed of a validated severity of illness score, an inter-professionally designed documentation record, and multi-domain recommendations for care escalation and de-escalation among hospitalized patients from term to 18 years of age. This 7-item score can quantify severity of illness in hospitalized children and identify critically ill children with at least one hour notice. Implementation of Bedside Pediatric Early Warning Systems (BPEWS) score may help in improving patient outcomes, reduce unnecessary ICU admissions and can add as guide to escalate medical care of critically sick children [4].

Relatively few studies especially from India have investigated the early mortality pattern of PICU admissions. Thus; the present study was conducted to assess the mortality profiles and BPEWS score of patients admitted in the Pediatric intensive care unit (PICU) of a tertiary care center.

AIMS AND OBJECTIVES:

AIM: Analysis mortality profile in Pediatric intensive care unit (PICU)

OBJECTIVES:

- Primary objective: To determine the mortality profiles of children who died within 48 hours of admission to Pediatric intensive care unit (PICU).
- Secondary objective: To correlate the Bedside Pediatric Early Warning System Score (BPEWS) at the time of admission with that of mortality.
- To analyze the factors responsible for mortality.

MATERIALS AND METHODS:

The present study was a Retrospective observational study & was conducted over a period of 18 months (January 2018 to December 2019).

Sampling technique: 44 consecutive patients during study period were enrolled in the study. Inclusion Criteria was Patients who died within 48 hours of admission to Pediatric intensive care unit (PICU) in the age group of 1 month to 12 years. Patient whose medical records were incomplete or unavailable were excluded from the study.

Methodology:

Approval from the institutional ethics committee was obtained prior to commencement of the study. Retrospective data for the duration of study was collected from the hospital's Medical Records Office. A pre-designed proforma was used and the demographic details, socioeconomic status, delay in admission, distance travelled, clinical details, investigations and cause of death were recorded. The variables necessary for BPEWS Score calculator were noted and the BPEWS Score was calculated. The score is calculated by summing the sub scores of each component depicted in Table -1.

Statistical Analysis: The data was analyzed using statistical software SPSS version 20.0 IBM New York. Pearson's correlation coefficient was used to assess the correlation between BPEWS score and mortality. A P value <0.05 was considered statistically significant.

Result: 44 children, mean age of patients was 2.67 years. Majority of patients 17(38.64%) were infants, followed by

14(31.82%) patients in the 1-5 years age group. Twenty five were females and 19 were males.

Mean duration of stay after admission to PICU was 19.68 (±12.36) hours; median was 18.57 hours and range was 3- 46 hours. Mean distance travelled was 8.31Km. In 21 patients (47.42%), distance from health facility was 5 to 10 Km. The delay in seeking health care was from 48—72 hours in 16 (36.36%) patients followed by 96 hours or more in 13(29.55%) patients.

Fourteen out of 17 infants were less than 6 months of age. and six of them had failure to thrive. Out of 21 children between 6 month to five years of age group, nine had Severe malnutrition, two had moderate malnutrition, 4 were underweight and one was stunted. More than fifty percent children were partially immunized. Anemia was found in 25% of patients.

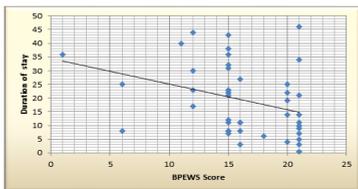
Respiratory system was the most commonly affected primary system observed in 21(47.73 %) patients, followed by Infection/Sepsis in 13(29.55%) patients. More than 90% of patients received ventilatory and inotropic support.

The mean (±SD) Bedside Pediatric Early Warning Symptoms Score (BPEWS) of study group patients was 16.16 (±4.54) and the median Bedside Pediatric Early Warning Symptoms Score (BPEWS) was 15.5 with Inter quartile range (IQR) of (10.5-20.5). Eight or higher score was attributed to maximum patients (93.18%).

Correlation of BPEWS Score with Duration of Stay:

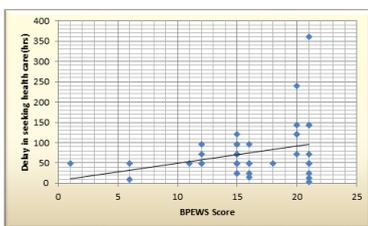
The BPEWS Score negatively correlated with duration of stay of study group patients after admission to PICU. The moderately negative Pearson's correlation coefficient 'r' was (r=0.331). Higher BPEWS Score was associated with a shorter duration of stay indicating higher and early mortality. See Fig -1

Fig : 1 Correlation of BPEWS Score with duration of stay.



Correlation of BPEWS Score with Delay in Seeking Health Care The BPEWS Score was positively correlated with delay in seeking health care among study group patients. The moderately positive Pearson's correlation coefficient 'r' was (r=0.307). A longer delay in seeking health care was positively associated with Higher BPEWS Score among study group patients. Correlation of BPEWS Score with delay in seeking health care is depicted in fig-2.

Fig: 2 Correlation of BPEWS Score with Delay in Seeking Health Care



Discussion:

The present study was a retrospective observational study conducted in a tertiary care hospital over a period of 18 months to determine the mortality profiles of Pediatric patients who died within 48 hours of admission to Pediatric

intensive care unit (PICU). A total of 44 patients were included in the study after applying the inclusion and exclusion criteria.

In the present study, mean age of patients was 2.67 years, 52.28 % patients were less than 1 year old and 84.1 % patients were less than 5yrs old. Under-five mortality contributes to half of pediatric deaths globally and findings of the present study are in agreement. Comparable findings have been reported by recent similar studies: In the study by Bhavari VL et al ^[1], in western India 43.2% patients were <1 year age and 72% were below 5 years of age. In the study by Abhulimhen-Iyoha BI et al ^[2], 50% of patients who died in PICU were infants which is comparable to present study and 72.4% patients aged <5 years.

In the present study, a slight female preponderance was observed where 56.82% patients were females and 43.18% were males. Varied findings have been reported by similar studies:

In the study by Bhavari VL et al [1], 54.7% cases were males. In the study by Sahoo B et al. ^[5] 61.3% patients were males and 38.7% females.

In the present study, 100% patients belonged to Lower socioeconomic class. Similar findings have been reported by other studies[5,6,7].

In the present study, 63.64 % patients had a compromised nutritional status. Under nutrition is associated with approximately half of all deaths in under 5 children. ^[5,6] Beyond having a direct impact on mortality, under nutrition increases the frequency and severity of pneumonia & diarrhea potentially representing a secondary immune deficiency[8].

In the present study, 50% patients were partially immunized or were not immunized which further increases risk for infections and mortality.

In the present study, Respiratory system was the most commonly affected primary system in 47.73 % patients, followed by Infection/Sepsis 29.55% patients and gastrointestinal system (4.55%) and Central Nervous System was primarily affected in 2 patients.

In the study by Kapil D and Bagga A [7], reported that septicemia was most common cause for admission in 14.8% patients; 13.8% children had congenital heart disease, 13.5% lower respiratory tract infections (LRTI) and 8.6% children had meningitis.

In India, Pneumonia and diarrheal diseases account for 50% of all deaths at 1-59 months.

Cause of PICU Mortality:

In the present study, septic shock was found to be commonest primary diagnosis followed by Pneumonia. Common Secondary causes of death were Anaemia, malnutrition and Global developmental delay. In the study by Rashma RP et al. [3] infectious disease was one of the commonest causes of PICU admission and mortality. The mortality pattern was cardiopulmonary arrest 29%, sepsis 19%, Pneumonia 16% and MODS 14%. GIT abnormality (18%) was most common co-morbid condition

In the study by Patki VK et al [9], sepsis, neurological cases and respiratory diseases were most common primary cause of mortality in PICU patients.

Great variation in primary cause of mortality in PICU deaths is present between developing and developed countries and regions. Sepsis (septic shock, septicemia) due to underlying infectious diseases is the major primary cause of mortality in

PICUs reported in studies from developing countries such as the present study and other similar studies described above [1,3,5,7]. A sizeable proportion of these deaths are preventable and avoidable by expanding scope of reproductive and child health programs and ensuring universal health coverage.

In developed countries withdrawal of life-sustaining therapy and brain death is predominant cause. Injuries, malignancies and cardiovascular and neurological diseases are most common causes of mortality in developed countries [10,11,12,13,14].

Pediatric Early Warning Score (PEWS):

In the present study the median Bedside Pediatric Early Warning Score BPEWS was 15.5, mean BPEWS was 16.16. The Bedside Pediatric Early Warning Symptoms Score (BPEWS) was 8 or higher in majority 93.18% patients and less than 8 in 6.82% and was distributed almost equally across all age groups. Higher BPEWS Score was associated with a shorter duration of stay indicating higher and early mortality. A longer delay in seeking health care was positively associated with higher BPEWS score among study group patients.

In the study by Tangsrichoer T and Kanjanavanit S [14], also investigated the performance of the Pediatric Early Warning Score (PEWS) to predict early deaths within 24 hours. PEWS in early death within and after 24 hours had mean PEWS 6.92 ± 1.91 and 5.17 ± 2.05 respectively. Higher PEWS was an effective predictor of early mortality similar to the present study.

In their study Parshuram CS et al [15], prospectively assessed if implementation of the bedside paediatric early warning system (BPEWS) and found its implementation to be feasible, safe and may improve clinical outcomes. In 2009 Parshuram CS et al [4], had developed and prospectively validated the BPEWS as simple bedside score to quantify severity of illness in hospitalized children. At a score of 8 sensitivity and specificity were 82% and 93% respectively.

PEWS can be used in multiple clinical settings to identify children for referral and not as measure of severity and its effectiveness can be increased by combining it with rapid response algorithm.

There are numerous PEWS and risk of mortality predictors (Pediatric Risk of Mortality PRISM, Pediatric Index of Mortality (PIM) scoring etc) used all over the world with inconsistent implementation and lack of standardization. Standardized evidence based National PEWS programme which can be implemented at national level with in built coordinated national evaluation can bring in standardization protocols in wards and ICUs to improve clinical outcomes and reduce pediatric mortality.

Strengths of the present study:

1. The present study findings add to the limited evidence of patterns of early mortality in PICU and its associated factors in current Indian scenario.
2. The present study findings also provide evidence of the utility and effectiveness of BPEWS score in Indian PICU setup.

Limitation:

The present study was conducted in one center for a limited duration. Multicentric, long term prospective studies with multiple arms using different PEWS can ensure comparisons across states and would provide more robust evidence of pediatric mortality patterns and effectiveness of PEWS in critical care settings.

CONCLUSIONS

Majority of early deaths (within 48hrs) after admission to PICU occurred in patients less than five years of age. Respiratory system followed by infection/sepsis and gastrointestinal tract

system were the most commonly affected primary system. Septic shock followed by pulmonary hemorrhage was the most common primary cause of death in the patients. Longer distance from health facility and higher BPEWS (>8) was associated with shorter duration of stay and higher mortality.

Table – 1 BPEWS Score calculator:

The components of the Bedside Paediatric Early Warning System score are depicted below:

Item	Age group	Item sub-score			
		0	1	2	4
Heart rate	0-3 months	>110 and <150	≥ 150 or ≤ 110	≥ 180 or ≤ 90	≥ 190 or ≤ 80
	3-12 months	>100 and <150	≥ 150 or ≤ 100	≥ 170 or ≤ 80	≥ 180 or ≤ 70
	1-4 years	>90 and <120	≥ 120 or ≤ 90	≥ 150 or ≤ 70	≥ 170 or ≤ 60
	4-12 years	>70 and <110	≥ 110 or ≤ 70	≥ 130 or ≤ 60	>150 or ≤ 50
	>12 years	>60 and <100	≥ 100 or ≤ 60	≥ 120 or <50	≥ 140 or ≤ 40
Systolic blood pressure	0-3 months	>60 and <80	≥ 80 or ≤ 60	≥ 100 or ≤ 50	≥ 130 or ≤ 45
	3-12 months	>80 and <100	≥ 100 or ≤ 80	≥ 120 or ≤ 70	≥ 150 or ≤ 60
	1-4 years	>90 and <110	≥ 110 or ≤ 90	≥ 125 or ≤ 75	≥ 160 or ≤ 65
	4-12 years	>90 and <120	≥ 120 or ≤ 90	≥ 140 or ≤ 80	≥ 170 or ≤ 70
	>12 years	>100 and <130	≥ 130 or ≤ 100	≥ 150 or ≤ 85	≥ 190 or ≤ 75
Capillary refill		<3 sec		≥ 3 sec	
Pulses		Normal	Weak	Doppler or bounding	Absent
Bolus fluid		No	Yes		
Respiratory rate	0-3 months	>29 and <61	≥ 61 or ≤ 29	≥ 81 or ≤ 19	≥ 91 or ≤ 15
	3-12 months	>24 or <51	≥ 51 or ≤ 24	≥ 71 or ≤ 19	≥ 81 or ≤ 15
	1-4 years	>19 or <41	≥ 41 or ≤ 19	≥ 61 or ≤ 15	≥ 71 or ≤ 12
	4-12 years	>19 or <31	≥ 31 or ≤ 19	≥ 41 or ≤ 14	≥ 51 or ≤ 10
	>12 years	>11 or <17	≥ 17 or ≤ 11	≥ 23 or ≤ 10	≥ 30 or ≤ 9
Respiratory effort		Normal	Mild increase	Moderate increase	Severe increase/any apnoea
Saturation		>94	91-94	≤ 90	
Oxygen therapy		Room air		Any - <4 L/min or <50%	≥ 4 L/min or ≥
Level of consciousness		Normal Consolable Arousable Bromage 0,1,S			Bromage score 2-3 Irritable
Temperature °C		≥ 36 and ≤ 38.5	<36 or >38.5	<35 or >40	

REFERENCES:

1. Bhavari VL, Ambike DA, Pawar ND. Study of morbidity pattern and outcome of patients admitted in paediatric intensive care unit in a tertiary care rural teaching hospital. *Int J Contemp Pediatr* 2019;6:2064-7.
2. Abhulimhen-Iyoha BL, Pooboni SK, Vuppali NK. Morbidity pattern and outcome of patients admitted into paediatric ICU in India. *Ind J Clin Med.* 2014;51-5
3. Rashma RP, Remya S, Jayakumar C, Shanavas M, Manu R, et al. Mortality Profile of Children Admitted to Intensive Care Unit of a Tertiary Care Hospital in Kerala, South India. *Int J Med Clin Sci.* 2018;1(1):13-16
4. Parshuram CS, Hutchison J, Middaugh K. Development and initial validation of the Bedside Paediatric Early Warning System score. *Crit Care.* 2009;13(4):R135
5. Sahoo B, Patnaik S, Mishra R, Jain MK. Morbidity pattern and outcome of children admitted to a paediatric intensive care unit of Eastern India. *Int J Contemp Pediatr.* 2017;4:486-9
6. Mridha D, Saha S, Prof. Ganguly S, Bose K. A Retrospective Evaluation of Morbidity Pattern and Outcome of Patients Admitted into a Pediatric Intensive Care Unit in India. *JMSCR* 2017;5(11):30589-90
7. Kapil D, Bagga A. The profile and outcome of patients admitted to a pediatric intensive care unit. *Indian J Pediatr.* 1993;60(1):5-10.
8. Wiens MO, Pawluk S, Kisson N, et al. Pediatric post-discharge mortality in resource poor countries: a systematic review. *PLoS One* 2013;8:e66698
9. Patki VK, Raina S, Antin JV. Comparison of Severity Scoring Systems in a Pediatric Intensive Care Unit in India: A Single-Center Prospective, Observational Cohort Study. *J Pediatr Intensive Care.* 2017;6(2):98-102.
10. Burns JP, Sellers DE, Meyer EC, Lewis-Newby M, Truog RD. Epidemiology of death in the PICU at five U.S. teaching hospitals. *Crit Care Med.* 2014;42(9):2101-2108.
11. Melissa DA ; David R L, Eugene, Long V; Wetzel, Randall C. Continuous Prediction of Mortality in the PICU: A Recurrent Neural Network Model in a Single-Center Dataset, *Pediatric Critical Care Medicine* 2021;22(6):519-529
12. Romaine ST, Sefton G, Lim E, et al. Performance of seven different paediatric early warning scores to predict critical care admission in febrile children presenting to the emergency department: a retrospective cohort study. *BMJ Open.* 2021;11(5):e044091.
13. Tadashi Ishihara, Hiroshi Tanaka. Causes of death in critically ill paediatric patients in Japan: a retrospective multicentre cohort study. *BMJ Paediatrics Open* 2019;3:e000499.
14. Tangsricharoen T., Kanjanavanit S .Performances of the Pediatric Early Warning Score (PEWS) to predict early deaths within 24 hours and causes of death in pediatric intensive care unit. *Journal of Nakornping Hospital*, 9(2)
15. Parshuram CS, Bayliss A, Reimer J, Middaugh K, Blanchard N. Implementing the Bedside Paediatric Early Warning System in a community hospital: a prospective observational study. *Paediatr Child Health.* 2011;16:e18-22