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Pediatric risk of mortality III score in predicting mortality in children with altered sensorium in pediatric intensive care unit

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ABSTRACT

Background: The Pediatric Risk of Mortality (PRISM) Score has been devised to predict outcome and risk of mortality. The PRISM III score is one of the most recent scoring systems of pediatric mortality. This was developed involving 32 PICUs. Physiological data included the most abnormal values from the first 12 and second 12 hours of the PICU stay. To evaluate the mortality rate in children with altered sensorium by applying PRISM III (pediatric risk of mortality) score.

Methods: This study was done in the paediatric intensive care unit of the Department of Paediatrics, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamil Nadu, India on 100 children of both sexes aged between 1 month and 13 years. The study was carried out for a period from December 2017 to July 2018. PRISM III scoring scale was applied for every child in his/her first 24 hours of PICU admission and their calculated score was recorded into the proforma. The clinical details at admission, laboratory data were recorded into the proforma.

Results: Three major groups that contributed to the bulk of the admissions were acute CNS infection, seizure disorder and, bites and stings. They constituted to around 54% of our total admissions. As PRISM III Score increases there is a steady increase in the mortality rate. This table shows that the mortality rate is 0% for the 0-9 group and that it increases to 100% for 20-29 and 30 and above groups as the PRISM III score increase.

Conclusions: PRISM III score provides an objective assessment of the severity of illness. PRISM III, when performed well, is good to predict mortality in an Indian PICU. Scoring systems with fewer laboratory parameters will be more useful in author's context. Larger studies are needed to develop/validate a mortality prediction score for our country.

Keywords: Anatomical injury, Cardiovascular disorders, Neurological manifestation, Pediatric risk of mortality

INTRODUCTION

Prognostication has always been the duty of a physician. This is perhaps particularly true in the case of critically ill patients. With progress in all specialties in paediatrics, paediatric critical care has also developed tremendously.¹ Paediatric intensive care units are becoming increasingly sophisticated in terms of types of equipment used and the

types of therapy administered in various acute illnesses. The evaluation and prognostication of all cases admitted to the Paediatric Intensive Care Unit (PICU) is important for various reasons.² Scoring systems aims at providing an objective measure of the severity and hence the prognosis of patients. They are also important for medical audit and in the comparison of cohorts of patients entering clinical trials.³ A scoring system is also a tool in

resource management. It helps in the allocation of limited PICU facilities and provides an index for the level of intervention appropriate for that patient. There is an increasing emphasis on the evaluation and monitoring of various aspects of health care services.⁴

The goal is to provide the highest quality of care with the available resources to achieve the best outcome.⁵ All scoring systems are designed to quantify and reduce the number of discreet but interrelated patient characteristics to a single value. This value can be used to further compare and analyze various aspects like disease severity, therapies used or final outcome.⁶ The scoring system forms the backbone of any hospital audit. Outcome audit can be done by measurement of mortality, morbidity, disability, functional health status and quality of life.⁷

In general health care, death is infrequent and hence an insensitive measure of outcome. However, in intensive care areas, deaths do offer a sensitive and appropriate measure. Thus, the prediction of mortality using scoring systems becomes a tool for the evaluation of the quality of care. Scoring systems aim at an equation to estimate the probability of an outcome.⁸ Each system has a group of independent variables (case mix) and the dependent variable (death) in the form of a mathematical equation.

The equation is applied to the current intensive care unit statistics and a death rate is derived. The actual and expected death rates are compared. Perhaps the first known scoring system developed was in the care of the newborn—the APGAR score, in 1953.

Many unscientific observations and steps for resuscitation were practiced at that time.⁹ The APGAR score, which assessed objectively cardiovascular, pulmonary and neurological systems, aimed to serve as a comparison of the results of obstetric practices, maternal sedation, and efficacy of resuscitation.¹⁰

The Paediatric Risk of Mortality (PRISM) score has been devised to predict outcome and risk of mortality. The PRISM III score is one of the most recent scoring systems of paediatric mortality. This was developed involving 32 PICUs. Physiological data included the most abnormal values from the first 12 and second 12 hours of the PICU stay.¹¹

METHODS

This study was done in the paediatric intensive care unit of the Department of Paediatrics, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamil Nadu, India on 100 children of both sexes aged between 1 month and 13 years.

The study was carried out for a period from December 2017 to July 2018. PRISM III scoring scale was applied for every child in his/her first 24 hours of PICU

admission and their calculated score was recorded into the proforma. The clinical details at admission, laboratory data were recorded into the proforma. It was a cross-sectional and analytic descriptive study.

Inclusion Criteria

All children aged between 1 month and 13 years admitted to PICU in a state of altered sensorium.

Exclusion Criteria

- Death within first 24 hours of PICU admission.
- Discharge from PICU <24 hours after PICU admission.
- Age <29 days and >13 years
- Presence of multiple congenital anomalies
- Children who were admitted for postoperative care and children with road traffic accidents.

For the above laboratory parameters, the values obtained at the time of admission were recorded. The child's course of PICU stay was monitored and the duration of stay and outcome were recorded.

The PRISM III scoring was assigned to each record. Studied children were classified into four groups according to this PRISM III scores. 0-9, 10-19, 20-29 and, 30 and above. The system-wide classification was done. For the purpose of analysis, those patients who were discharged against medical advice were included in the deaths.

Statistical analysis

The association between study variables and the outcome was tested with the chi-square analysis. The appropriateness of the model is assessed by Hosmer-Lemeshow summary Chi-square test and also by the Receiver Operating Characteristics (ROC) Curve analysis. A p-value <0.05 was considered significant.

RESULTS

Table 1 shows one hundred children (mean age of 5.06 ± 1.2 years) including 17 infants (mean age of 0.7 ± 0.3 months), 71 children (mean age of 7 ± 1.8) and 12 adolescents (mean age of 12.5 ± 0.7) enrolled into this study.

Table 2 shows classification according to working diagnosis central nervous system causes (43.0%), bites and stings (18.0%), metabolic causes (11.0%) group constitute the majority of our study population.

Table 3 shows total numbers of 100 children were analyzed, authors had 11 deaths and one child went against medical advice (AMA). For analytical purpose, the AMA case was included in deaths. Out of a hundred

children our mortality rate is high in infant (17.6%) age group.

Table 1: Age distribution.

Age	Cases n=100
Infant (30 days to 1 year)	17 (17.0)
Children (1-12 years)	71 (71.0)
Adolescent (12-13 years)	12 (12.0)

Table 2: Classification according to working diagnosis.

Diagnosis	N=100	%
Central nervous system causes	43	43.0
Bites and sting	18	18.0
Metabolic causes	11	11.0
Dyselectrolytemia	8	8.0
Respiratory causes	8	8.0
Renal causes	7	7.0
Hepatic causes	5	5.0

Table 3: Distribution of mortality among different age groups.

Age	Cases n=100	Death n=12	%
Infant	17	3	17.6
Children	71	7	9.8
Adolescent	12	2	16.6

Table 4: Mortality according to diagnosis.

Diagnosis	Cases n=100	Death n=12
Acute CNS infection	25	4 (16.0)
Seizure disorder	11	0
Diabetic keto acidosis	11	1 (9.1)
Dyselectrolytemia	8	0
Renal causes	7	0
Aspiration pneumonia meningism	8	1 (12.5)
Hepatic encephalopathy	5	1 (20)
Space occupying lesion	4	0
Bites and sting	18	2 (11.0)
Others	3	3 (100.0)

Table 4 shows mortality rate was high for those with hepatic causes, acute CNS infection and respiratory disorder being 20.0%, 16.0%, and 12.5% respectively. Three children initially worked up for a cause, expired before a definitive diagnosis could be made.

In Table 5, 82% of children are belongs to the PRISM III score between 10-19. Mean PRISM III score for all children 12.2 ± 1.8 . Mean for minimum score 6.0 ± 1.1 . Mean for maximum score 30.0 ± 1.1 .

Table 6 shows as PRISM III score increases there is a steady increase in the mortality rate. This table shows that

mortality rate is 0% for the 0-9 group and that it increases to 100% for 20-29 and 30 and above groups as the PRISM III score increase, p value <0.001 . The capacity of PRISM III scoring system for discrimination between survived and expired children. ROC analysis in this study indicated a strong predictive power for the PRISM III as following: For the total studied children under curve surface area=0.997 with a standard error of 0.003, p <0.001 with 95% CI=0.991-1.004.

Table 5: PRISM III score distribution.

Score	No. of cases n=100	%
1-9	8	8.0
10-19	82	82.0
20-29	6	6.0
>30	4	4.0

Table 6: Prism III score and observed outcome.

Prism	Total	Discharge n=88	Death N=12
0-9	8	8 (100.0)	0 (0.0)
10-19	82	80 (97.6)	2 (2.4)
20-29	6	0 (0.0)	6 (100.0)
$>=30$	4	0 (0.0)	4 (100.0)

DISCUSSION

The use of scoring systems and the audit of intensive care has not been widely reported in India. There have been few studies addressing the needs of paediatric critical care. Most scoring systems are designed in the west and need to be validated in our country.¹² Singhal D et al, found out that most of their admissions were less than 1 year (46%).³ Mean age in our study population was 5.06 ± 1.2 years.¹³ The mean age of the patient studied by Pollack MM et al, was between 2-3 years, which is lesser compared to present study. Mean PRISM III score was 12.2 ± 1.8 for all patients, survivor mean score was 15.1 ± 1.1 and non-survivor mean score was 27.0 ± 1.1 .¹⁴ The study done by Tan GH, showed survivor mean score 17 and non-survivor of 36. Mean of admission day in PICU for survivors was 5.11 ± 3.59 and for non-survivors was 5.60 ± 7.26 . In this study, as the PRISM III score increased from 0 to 30, the mortality rate rose from 0 to 100%. The performance of the PRISM III score in present study showed a good performance of prediction of mortality with the ROC curve analysis having an area under the curve of just 0.997.¹⁵ Teasdale G et al, found the ROC analysis to be 76% in their study using the PRISM score. Their conclusion was that the PRISM score was a good predictor of mortality.¹⁶ In Webb et al, study the expected mortality underestimated in the group at low risk for mortality and overestimated in the group at very high risk of mortality. The concept of lead time has been widely discussed. As the PRISM scoring is done at the time of admission to PICU, the physiological instability with which a patient presents to the emergency room is not accounted for. The various therapies started

in the emergency room to maintain optimal vital parameters present a falsely low score at admission to the PICU. This is obviously not representative of the true physiological disturbances. e.g. the PRISM III score has no provision for scoring a hypoxic child started on supplemental oxygen or even intubated in the emergency room.¹⁷

Present study also showed similar results to that of Wells M et al, were infants less than 12-month constitute had mortality 17.6%. Majority of death occur during initial 0-4 days of hospital stay.¹⁸ Though PRISM III has been a good predictor of mortality based on this study its measurement is not without merit. As the mean PRISM III score is significantly lower in those who recovered (15.1±1.1) and those that died (27±1.1), its estimation does throw light on the severity of the disease process. The PRISM III scores were equally valid in the three main subgroups of hepatic, CNS, respiratory disorders. These subgroups will form the majority of cases in our PICU.¹⁹ Zuckerman MD et al, suggested that PRISM score can be a good predictor for short- term outcome in PICU with respect to geographic region, specific disease and pattern of post ICU mortality/morbidity in children.²⁰

CONCLUSION

PRISM III scores provide an objective assessment of the severity of illness. PRISM III, when performed well, is good to predict mortality in an Indian PICU. Scoring systems with fewer laboratory parameters will be more useful in our context. Larger studies are needed to develop/ validate a mortality prediction score for our country. Education, training, and guidelines for score assessment is needed, and perhaps the severity of illness scoring in PICUs should be performed only by a limited number of well-trained professionals. Scoring should be done in the emergency room after initial stabilization for better interpretation.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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