

Prediction Of Mortality By Pediatric Risk Of Mortality (PRISM) III Score In NGMC Pediatric Intensive Care Unit

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ABSTRACT

Background: The pediatric risk of mortality (PRISM) III score helps in predicting prognosis. It is being used in most of the pediatric intensive care units of developed world and few of developing ones. We have undertaken this study to evaluate efficacy of PRISM III score in prediction of mortality. **Material and Methods:** Prospective hospital based analytical study conducted from May 2018 to April 2019 in patients admitted to pediatric intensive care unit (PICU) of NGMC, Nepal. The pediatric risk of mortality score (PRISM) III which includes 14 parameters (physiological and laboratory) was recorded within 24 hours of admission. A total of 480 patients were included. The final outcome was recorded as death or discharge. **Result:** It was observed that mortality increased with increasing PRISM III score approaching almost 100% by PRISM III score of 25 and more. The variables that were found to be risk factors for death were readmission, diseases of hepatobiliary system, mechanical ventilation (MV) and use of vasoactive drugs with p value of <0.001. PRISM III score offers a good discriminative power with 0.866 (95% CI) area under the ROC curve. **Conclusion:** The pediatric risk of mortality score was found to be a useful tool for prediction of prognosis.

Keywords: Pediatric risk of mortality score, mortality, pediatric intensive care unit

INTRODUCTION

The pediatric intensive care unit facilities are improving for last few years in different parts of our country with opening and improvement of the pediatric intensive care units. The outcome of the patients admitted to PICU is not widely reported in Nepal, despite the necessity to know the scope of improvement and work on it, need of more advanced equipment and aggressive treatment of critically ill children of units being known. Reduction of mortality is the basic aim of PICU. Estimation of mortality risk predictions by pediatrician is highly subjective.¹ Therefore there is need of a scoring system to predict risk of mortality of patients admitted to PICU. PRISM III score is very useful in estimating the risk of mortality, prognosis and to evaluate quality of care. It also helps selection of appropriate treatment modality, ethical and economic issues. PRISM III score is one of the main indicators used in PICU. There are 14 parameters (physiological and laboratory) and each parameter records highest severity value in first 24 hours.² The aim of present study is the prediction of mortality rate in PICU by application of PRISM III score.

To improve the quality of care in PICU, it is very important to have a constant relationship between test parameters and

outcome of patients. The PRISM score has been developed and validated in most of the PICUs of developed countries and there are very few reports from some developing countries^{1,3,4}. Google search using term "PRISM III scoring in Nepal" did not show any study done in Nepal. Expertise of health personal managing PICUs varies depending upon their experience and training. PICUs are managed by pediatric consultants, residents, nurses who have different subjective perceptions of score to be given. There are some reports from India which support usefulness of PRISM III score for prediction of prognosis^{3,4}.

MATERIALS AND METHODS

This is a prospective hospital based study conducted at the PICU of Nepalgunj Medical College, Nepalgunj catering to critical care needs of 500–600 children per year from 1 month to 15 years of age. This study was conducted over a period of 1 year from May 2018 to April 2019. During the study period a total of 480 cases were enrolled in the study. Readmission was taken as separate admission. PRISM III score was calculated for all the patients within 24 hours of admission. Pediatric cases aged between 1 month and 15 years admitted directly to PICU were included in the study. Patients not giving consent to be enrolled in the study, death occurring within first 10 hours of PICU admission, case which were discharged from PICU within 24 hours of admission, patient requiring continuous CPR and not being stable for ≥ 2 hours and patients who left against medical advice were excluded from the study.

The study design was approved by the Institution's Ethical review committee. Written and informed consent was taken from the guardian of patients. The information collected on each PICU admission included name, age, requirement of

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ventilator, PICU stay, diagnosis, outcome (survived or not). Necessary investigations were done as per need. PRISM III score was calculated within 24 hours of admission in PICU. Calculation of PRISM III score was done as per recommendation of Pollack et al⁵. Total PRISM III score was calculated for every patient by summing of all the sub scores within 24 hours of admission. The data was analyzed by SPSS version 20.

Variables	Age restrictions and Range		Score
Systolic blood pressure in mmHg	Infants	Children	2
	130-160	50-200	
	55-65	65-75	6
	>160	>200	
	40-54	50-64	7
	<40	<50	
Diastolic Blood pressure in mmHg	All ages		6
	>110		
Heart rate in beats per minute	Infants	Children	
	>160	>150	4
	<90	<80	4
Respiratory rate in breaths per minute	Infants	Children	
	61-90	51-70	1
	>90	>70	5
	Apnea	Apnea	5
PaO ₂ /FiO ₂	All ages	200-300	2
		<200	3
PaCO ₂ in torr(mmHg)	All ages	51-65	1
		>65	5
Glasgow coma score	All ages	<8	6
Pupillary reactions	All ages	Unequal or dilated	4
		Fixed and dilated	10
PT/ PTT	All ages	4-5 minutes	2
Total bilirubin mg/dL	>1 month	>3.5	6
Potassium in mEq/L	All ages	3.0-3.5	1
		6.5-7.5	1
		<3.0	5
		>7.5	5
Calcium in mg/dL	All ages	7.0-8.0	2
		12.0-15.0	2
		<7.0	6
		>15.0	6
Glucose in mg/dL	All ages	40-60	4
		250-400	4
		<40	8
		>400	8
Bicarbonate in mEq/L	All ages	<16	3
		>32	3

Table I: PRISM III score Pollack et al.5

RESULTS

During the study period 531 cases were admitted in the Pediatric Intensive Care Unit from May 2018 to April 2019 out of which only 480 cases met inclusion criteria and hence were enrolled in the study. The mean age was found to be 39±47 months and mean duration of PICU stay was 56±44 hours. There were 317 males and 163 females; mortality among different sexes was not statically significant (P value 0.175). The majority of patients were clinical (98.5%) and the most common cause of death was the diseases of respiratory system (38.8%). Mechanical ventilation and vasoactive drugs were required in 22.5% and 23.1% cases respectively. Mortality was 9.2%. The characteristics of the study population are detailed in Table II. Mortality associated with PRISM score of expired and survived patients is detailed in table III. The variables that were found to be risk factors for death were readmission, diseases of hepatobiliary system, mechanical ventilation (MV) and use of vasoactive drugs with p value of <0.001. Variables found to be risk factors of death are given in table IV. PRISM III score in our center offers a good discriminative power with 0.866 (95% CI) area under the ROC curve. This area under the curve is an expression of the overall accuracy of a model in differentiating outcome groups and is a good measure of its predictive ability. Inspecting the ROC curve, cut off point 15 was found to be appropriate to predict mortality so taking 15 as cut off point the sensitivity was 72.7% and specificity was 91.1%.

Variables	N (%)	
Total patients	480	
Age (months)		
Length of PICU stay (hours)		56 ±44.182
Gender		
Male	317 (66)	
Female	163 (34)	
Patients		
Clinical	473 (98.5)	
Surgical	7 (1.5)	
Underlying disease		
Central Nervous System	160 (33.3)	
Respiratory System	186 (38.8)	
Hepatobiliary	11 (2.3)	
Infectious disease	42 (8.8)	
Hematological disease	31 (6.5)	
Renal disease	10 (2.1)	
Gastrointestinal disease	9 (1.9)	
Cardiovascular disease	12 (2.5)	
Others	19 (4)	

Use of mechanical ventilation		
Yes	108 (22.5)	
No	372 (77.5)	
Use of vasoactive drugs		
Yes	111 (23.1)	
No	369 (76.9)	
Deaths	44 (9.2)	

Table II -Characteristics of study population

PRISM III Score	Death	Survival	Total	Observed morality (%)
0-4	5	151	156	3.2
5-9	2	175	177	1.1
10-14	5	71	76	6.6
15-19	5	25	30	16.7
20-24	3	10	13	23.1
25-29	6	2	8	75
30-34	5	2	7	71.4
35-39	5	0	5	100
40-44	4	0	4	100
45-49	4	0	4	100

Table III-PRISM comparison between expired and survived patients

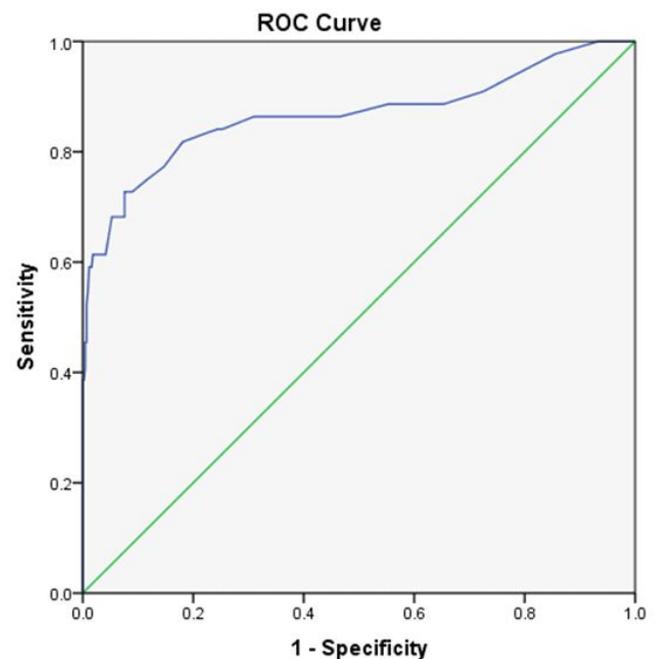
Variable	Category	Deaths n (%)	p
Age (months)	1-12	24 (10.7)	0.540
	13-60	12 (7.6)	
	61-180	8 (8.2)	
Length of PICU stay (hours)	25-72	40 (10.5)	0.116
	73-168	4 (4.5)	
	>168	0 (0)	
Gender	Male Female	25 (7.9) 19 (11.7)	0.175
Patients	Clinical Surgical	44 (9.3) 0 (0)	0.397
Readmission	Yes No	5 (55.6) 39 (8.3)	<0.001
Underlying disease	Central Nervous System	9 (5.6)	<0.001
	Respiratory System	18 (9.7)	
	Hepatobiliary	5 (45.5)	
	Infectious disease	5 (11.9)	
	Hematological disease	3 (9.7)	
	Renal disease	0 (0)	

	Gastrointestinal disease	0 (0)	
	Cardiovascular disease	3 (25)	
	Others	1 (5.3)	
Use of mechanical ventilation	Yes	35 (32.4)	<0.001
	No	9 (2.4)	
Use of vasoactive drugs	Yes	34 (30.6)	<0.001
	No	10 (2.7)	

Table IV -Risk factors for death

Patient	PRISM Mean	p
Expired	25.20	<0.001
Survived	7.27	

Table V – PRISM comparison between patients who died and survived



Diagonal segments are produced by ties.

Figure 1: ROC curve for prism score area under curve = 0.866

Area under the ROC curve (AUC)	0.866
Standard Error	0.039
95% Confidence interval	0.790 -0.942
Significance level P	<0.001

DISCUSSION

Response to an insult differs in different individuals so recovery from illness also varies in different individuals. Prediction of outcome of patients admitted to PICU helps in formulating policy and optimum use of limited resources of the country. Intent of pediatric intensive care unit is to improve quality of care and to reduce the morbidity and mortality. PRISM III score helps in prediction of mortality risk by changes of normal physiological values during diseased state. This was designed by Pollack et al. in 1996⁵. Various studies have shown PRISM III score to be a good predictor of mortality risk assessment. At our center we found the mortality of 9.2% which is low in comparison to studies⁶⁻⁸ and is more as compared to studies.⁹⁻¹¹ Bilan et al¹² found mortality of 9.05% in their study done in Pakistan which is similar to ours. We found that as the PRISM score increases mortality also increases and this fact is supported by various Indian, Asian and other studies^{6,7,9,10,12,13,14}. There was no significant gender difference in mortality in our study. Costa et al¹⁵ also found no gender difference for mortality whereas Aragao et al¹⁶ found mortality to be more in males. The use of mechanical ventilation and vasoactive drugs were found to be risk factors for death, corroborating the findings of other authors who also showed a higher mortality rate in patients undergoing these procedures^{16,17}. PRISM III score of ≥ 25 was associated with very high mortality in our study. Martha et al¹⁸ and several other studies^{19,20} also reported higher mortality with higher PRISM scores. Shann et al²¹ stated that if the area under the curve of ROC is equal to one, the model is perfect. An area between 0.9 and 0.99% is very good, between 0.8 and 0.89% is good and finally, between 0.7 and 0.79% is acceptable. If the area is 0.5, the model is bad. In our study, the area under the curve was 86.6%, so it is good to predict mortality in patients admitted to PICU. Khajeh A et al²² reported area under the curve to be 80% which is similar to our study.

CONCLUSION

The mortality increases with increasing PRISM III score. PRISM III score offers a good discriminative power in prediction of mortality with 0.866 (95% CI) area under the ROC curve. In our study variables found to be risk factors for death were readmission, diseases of hepatobiliary system, mechanical ventilation (MV) and use of vasoactive drugs.

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