

## ESTIMATION OF SHORT-TERM OUTCOMES IN PATIENTS ADMITTED IN PICU BY APPLICATION OF A SEVERITY OF ILLNESS SCORE (PRISM-III SCORE)

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### ABSTRACT

#### BACKGROUND

The concept of Paediatric intensive management is changing rapidly worldwide. But there are no definite parameters available for the assessment of the patient's severity. There was an intense need to conduct study which deals with the assessment of patient but also helps in prognosticating the patient and help in counseling the parents at the time of admission. The severity of sickness is assessed on the basis of PRISM-III Score (Paediatric Risk of Mortality), that is an internationally accepted standard score.

#### MATERIALS AND METHODS

The present prospective observational study was carried out during October 2015 to September 2016 in Paediatric Intensive Care Unit (PICU) of Prakash Institute of Medical Sciences and Research, Urun-Islampur. All patients admitted to PICU during October 2015 to September 2016 who fulfilled the inclusion criteria were enrolled in the study.

#### RESULTS

Among the physiological parameters BP, GCS and pupils showed statistically significant association with mortality. Heart rate and temperature did not show any significant relation with mortality. Only 4 patients had severe tachycardia as risk factor. We did not find any significant association between these parameters and mortality. Among lab parameters studied, ABG showed significant association with mortality with 64.7% mortality for children with pH less than 7.28. On evaluation of chemistry tests Potassium, Creatinine and BUN showed good association with mortality. 38.5% mortality for glucose values < 80, which was statistically significant. Based on Haematological tests, PT and PTT showed significant association with mortality. WBC count and platelet count did not show significant association with mortality.

#### CONCLUSION

PRISM III score has good predictive value in assessing the probability of mortality.

#### KEY WORDS

PICU, PRISM Score, Paediatric Intensive Care, Mortality.

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#### BACKGROUND

Paediatric intensive care unit (PICU) is an important component of tertiary paediatric care services. The clinical judgement of the severity of a disease process is not uniform. Prediction of patient outcome is important for the patients and family and is relevant for policy formulation and resource allocation.<sup>1</sup> In developing countries, most of the units lack in technical equipment. The staff available in PICU settings is usually inadequately trained and clinical experience regarding paediatric intensive care is limited. Hence, when patients with varying prognosis and degrees of clinical severity are being treated, the final strategy of employing the resources available optimally at such units is often uncertain.<sup>2</sup>

Risk adjustment tool that predict death in PICU have become established in the past 20 years. It is based on

principles developed in adult (APACHE III)<sup>3,4</sup> and paediatric severity of illness scoring systems (PSI).<sup>5</sup> PRISM-III is based on the hypothesis that physiologic instability directly reflects mortality risk and does not depend on diagnosis. In 1988, Pollack et al<sup>6</sup> developed a risk adjustment method, the Paediatric Risk of Mortality (PRISM) score based on acute physiological derangement, to facilitate comparisons of mortality between different populations of critically ill children. Limited multicenter validation<sup>7</sup> has been published and no equivalent studies from India are available.

PRISM scoring system was originally composed of 14 physiologic variables obtained on admission to the PICU and 2 general diagnostic/ demographic variables which were entered into a logistic regression equation which computed severity adjusted risk of mortality. It was recalibrated and revised in 1996 as PRISM III.<sup>8</sup> PRISM III has 17 physiologic variables and 4 general diagnostic/ demographic variables which are subdivided to total 26 parameters. It remains the gold standard for benchmarking the performance of PICUs in most of the developed countries. As much as 10 various versions of the PRISM family of risk adjustment tools have been used extensively in the United States.

PRISM-III score can be used to evaluate quality of medical care in PICU and to optimize the employment of resources. Since the score compares mortality adjusted by disease

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severity, this can be used for the comparison between clinical trials and for intra or inter PICU comparison.<sup>9</sup>

PRISM-III score takes into consideration clinical and laboratory variables encompassing diverse organ functions. This may prevent under-representation of any particular variable, which in turn may avoid under prediction.<sup>10</sup>

### Aims and Objectives

Estimation of short-term outcomes in patients admitted to paediatric intensive care unit by application of a severity of illness score (PRISM-III Score).

### MATERIALS AND METHODS

The present prospective observational study was carried out during October 2015 to September 2016 in Paediatric Intensive Care Unit (PICU) of Prakash Institute of Medical Sciences and Research, Urun-Islampur. All patients admitted to PICU during October 2015 to September 2016 who fulfilled the inclusion criteria were enrolled in the study.

### Study Design

Prospective observational study.

### Settings

Prakash Institute of Medical Sciences and Research, Urun-Islampur, Maharashtra. Prakash Institute of Medical Sciences and Research is a Medical College, as tertiary care unit giving services as referral unit for sick paediatric patients. Five (5) bedded Paediatric Intensive Care Unit (PICU) is with the Department of Paediatrics. All the patients are attended by paediatric resident. 24 hours service is available of microbiology and pathology department of hospital for laboratory investigations.

### Duration of Study

October 2015 to September 2016- One year.

### Data Analysis

Chi-square test was applied to assess statistical significance between variables and statistical analysis was done by 11 version of SPSS Software.

### Inclusion Criteria

All sick children aged 1 month to 12 years admitted in PICU fulfilling the following criteria: 1) With evidence of respiratory failure, 2) With cardiovascular shock, 3) With acute neurological deterioration, 4) With acute renal failure requiring dialysis, 5) With bleeding disorders requiring massive transfusion.

### Exclusion Criteria

Death within the first 10 hrs. of PICU admission, post-operative patients.

### Consent

Informed consent was taken from family and admitting paediatrics consultant.

### Sample Size

- 100 sick paediatric patients admitted in PICU.
- Data was categorised in 3 groups depending on the age:
- 1 month to 1 year, 1 to 6 years and 6 to 12 years.

### Groups on the Basis of the Total PRISM-III Score

The total PRISM-III score for each patient was calculated by summing up the individual score of each parameter and patients were grouped into 3 groups as below- Group I- 0 to 9, Group II- 10 to 19 and Group III- 20+.

### In each group following Parameters were noted-

- Number of patients alive.
- Number of patients dead.

Number of total deaths in each category was recorded and it was compared against the expected number of deaths in each category.

Variable	Age and Ranges			Score
Temperature	< 91.4 and > 104°F			3
	91.5 - 103.9°F			0
Systolic blood pressure (mmHg)	<b>Infant</b>	<b>Child</b>	<b>Adolescent</b>	
	45 - 65	55 - 75	65 - 85	3
	< 45	< 55	< 65	7
	> 65	> 75	> 85	0
Heart rate (beats/min)	215 - 222	185 - 205	145 - 155	3
	> 225	> 205	> 155	4
	< 215	< 185	< 145	0
Pupils	All ages			
	One fixed and one reactive			7
	Both non-reactive			11
	Both normal in size and reaction			0
Level of consciousness	All ages			
	Stupor/coma (GCS* <8)			5
	> 8			0
PH	All ages			
	7 - 7.28			2
	< 7			6
	> 7.55			3
	7.28 - 7.48			0
Total CO <sub>2</sub> (mmol/L)	All ages			
	5 - 16.9			2
	< 5			6
	> 34			4
	17 - 33.9			0
PaO <sub>2</sub> (mmHg)	All ages			
	42 - 49.9			3
	< 42			6
	> 50			0
PCO <sub>2</sub> (mmHg)	All ages			
	50 - 75			1
	> 75			3
	< 50			0
Glucose (mg/dL)	All ages			
	> 200			2
Potassium (mmol/L)	< 200			0
	All ages			
	> 6.9			3
Creatinine (mg/dL)	< 6.9			0
	<b>Infant</b>	<b>Child</b>	<b>Adolescent</b>	
	> 0.90	> 0.90	> 1.30	2
Blood Urea Nitrogen (BUN)(mg/dL)	< 0.90			0
	All ages			
WBC (cell/mm <sup>3</sup> )	> 14.9			3
	< 14.9			0
WBC (cell/mm <sup>3</sup> )	All ages			
	< 3000			4
	> 3000			0

Platelet count (cell/mm <sup>3</sup> )	All ages	
	1,00,000 - 2,00,00	2
	50,000 - 99,999	4
	< 50,000	5
Prothrombin time (PT)(sec) or Partial thromboplastin time (PTT) (sec)	All ages	
	PT > 22 or PTT > 57	3
	PT < 22 or PTT < 57	0

**Table 1. PRISM Score**

\*GCS- Glasgow Coma Scale.

**RESULTS**

- Total no. of patients admitted at PICU of PIMSR in the study period- 300
- Number of patients eligible for study- 150
- Number of babies excluded- 49
- Post-operative patients- 44
- Death within the first 10 hours of PICU admission- 5
- Number of patients enrolled- 101

Based on Physiological Parameters				
Parameters	Range	Died	Survived	P value
Systolic BP	PRISM Score 0	4 (23.45)	8 (9.5)	0.001
	PRISM Score 3	10 (58.8)	75 (89.3)	
	PRISM Score 7	3 (17.6)	1 (1.2)	
Heart Rate	PRISM Score 0	15 (88.2)	82 (97.6)	0.059
	PRISM Score 3	1 (5.9)	2 (2.4)	
	PRISM Score 4	1 (5.9)	0(0.0)	
Temperature	< 100	11 (17.2)	53 (82.8)	0.900
	> = 100	6 (16.2)	31 (83.8)	
Pupils	Normal	13 (13.2)	84 (86.6)	0.000
	Abnormal	4 (100.0)	0 (0.0)	
GCS	< 8	10 (58.8)	22 (26.2)	0.011
	> = 8	7 (41.2)	62 (73.8)	
Based on ABG				
PH	< 7.28	11 (64.7)	14 (16.7)	0.000
	7.28 - 7.48	4 (23.5)	54 (64.3)	
	> 7.48	2 (11.8)	16 (19.0)	
PaO <sub>2</sub>	< 42	1 (5.9)	4 (4.8)	0.029
	42 - 49.9	3 (17.6)	2 (2.4)	
	> 49.9	13 (76.5)	2 (2.4)	
PCO <sub>2</sub>	< 50	14 (82.4)	82 (97.6)	0.033
	> = 50	3 (17.6)	2 (2.4)	
Total CO <sub>2</sub>	< 5	0 (0.0)	1 (100.0)	> 0.05
	5 - 16.9	5 (38.5)	8 (61.5)	
	16.91 - 34	9 (11.4)	70 (88.6)	
	> 34	3 (37.5)	5 (62.5)	

**Table 2. Comparison of Mortality based on Physiological Parameters and on Laboratory Parameters based on ABG**

Based on Chemistry Tests				
Parameters	Range	Died	Survived	P value
Potassium (mmol/L)	< 6.9	14 (82.4)	82 (97.6)	0.033
	> = 6.9	3 (17.6)	2 (2.4)	
Creatinine (mg/dL)	< 0.9	10 (12.2)	72 (87.8)	0.010
	> = 0.9	7 (36.8)	12 (63.2)	
BUN (mg/dL)	< 14.9	5 (8.3)	55 (91.7)	0.006
	> = 14.9	12 (29.3)	29 (70.7)	
Glucose (As per PRISM-III) (mg/dL)	< 200	12 (70.6)	71 (84.5)	0.158
	> = 200	5 (28.4)	13 (15.5)	
Glucose (Various ranges including hypoglycaemia)	< 80	5 (38.5)	8 (61.5)	0.025
	80 - 120	6 (13.6)	38 (86.4)	
	120 - 200	1 (3.8)	25 (96.2)	
	> = 200	5 (27.8)	13 (72.2)	
Based on Haematological				
WBC (cell/mm <sup>3</sup> )	< 3000	2(50.0)	2 (50.0)	0.070
	= 3000	15(15.5)	82 (84.5)	
Platelets (cell/mm <sup>3</sup> )	< 50000	3(15.8)	16 (84.2)	0.722
	50,000 - 1 lakh	2 (28.6)	5 (71.4)	
	1 lakh - 2 lakhs	5 (20.8)	19 (79.2)	
	> 2 lakhs	7 (13.7)	44 (86.3)	
PT (sec)	< = 22	9 (12.2)	65 (87.8)	0.038
	> 22	8 (29.6)	19 (70.4)	
INR	< 1.5	13 (15.7)	70 (84.3)	0.729
	> = 1.5	4 (22.2)	14 (77.8)	
PTT (sec)	< = 55	9 (11.8)	67 (88.2)	0.019
	> 55	8 (32.0)	17 (68.0)	

**Table 3. Comparison of Mortality based on Chemistry Tests and based on Haematological Tests**

INR- International Normalized Ratio.

Author	Number of Patients Studied	ROC (%)
Our Study	101	0.924
Singhal D et al <sup>1</sup>	100	0.72
Pollack MM et al <sup>11</sup>	11165	0.950
Choi et al <sup>12</sup>	303	0.910
Gemke R J et al <sup>13</sup>	300	0.78
Slater and Shann <sup>14</sup>	26966	0.93
S Leteurtre et al <sup>15</sup>	802	0.92

**Table 4. In other Similar Studies comparison Seen As**

**DISCUSSION**

PRISM-III score has been well evaluated for the assessment of the sickness in the PICU of the developed countries. It is an internationally accepted standard scoring system. There were very few studies on the assessment of the PRISM-III scoring system in Indian population. So, we evaluated the functioning of PICU (PIMSR Hospital, Islampur) by PRISM-III scoring system.

This study was conducted over the period of one year. We admitted total of 300 patients in our PICU, out of which only 150 were eligible for our study. Out of these, we excluded 44 patients who were post-operative and having surgical complications. Five patients were excluded, because they died within 10 hours of admission.

We had evaluated the individual physiological and laboratory parameters of PRISM-III score and their

association with mortality. Among the physiological parameters, BP, GCS and Pupils showed statistically significant association with mortality. When we evaluated heart rate and temperature individually, they did not show any significant relation with the mortality. We can explain these findings by the fact that we had very few patients in seriously ill group with the most abnormal vitals. For example, according to PRISM-III score, temperature is the risk factor only when it is more than 104°F or < 91.4°F. In our study, only one patient fulfilled those criteria. Similarly, according to PRISM-III only severe tachycardia has been considered as risk factor, whereas bradycardia has not been given any score. Only 4 patients had severe tachycardia as risk factor, which is too small a number. This may be the reason why we did not find any significant association between these parameters and mortality.

Among the Lab parameters studied, ABG showed significant association with mortality with 64.7% mortality for children with pH less than 7.28. On evaluation of chemistry tests Potassium, Creatinine and BUN showed good association with mortality. When we stratified glucose values according to PRISM-III, p-value was not significant. Since we had 13 children with glucose values less than 80, we stratified glucose values into various ranges and analysed. It showed 38.5% mortality for glucose values < 80, which was statistically significant. So we feel that hypoglycaemia should be considered as an important risk factor for mortality. Based on Haematological tests, PT and PTT showed significant association with mortality. WBC count and platelet counts did not show significant association with mortality.

#### CONCLUSION

According to the results of our study, health care quality in the PICU of PIMSR Hospital is at par with similar worldwide health care systems. PRISM-III score can be reliably used in our PICU as predictor of mortality. PRISM-III score has good predictive value in assessing the probability of mortality in relation to children admitted to PICU under Indian circumstances.

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