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Risk Factors for Predicting Mortality in a sick children in Paediatric Intensive Care Unit in developing country

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Abstract

Aim: The aim of this study is to assess risk factors contributing to increased mortality and their association with PRISM III 24 hour score in PICU. **Materials and Methods**: In this observational prospective study, 200 children admitted fulfilling inclusion criteria during 24 months period were enrolled in this study. PRISM III-24 score and mortality risk factor were calculated. Follow up was noted as discharge or death. **Result:** of 200 patients 115 male and 85 female.45 died and155 survived. PRISM III-24 score showed an increase of mortality from 4% in 0-9 score patients to 83.3% in ≥ 30 score. The presence of GCS score ≤ 8,MODS on admission ,need of inotropes and mechanical ventilation was significantly associated with poor outcome and well correlated with PRISM III score on univariate linear regression analysis. MODS on admission,mechanical ventilation and need of inotropes are independant predictors for PICU mortality on multiple logistic regression analysis. **Conclusion:** GCS score ≤ 8 ,MODS on admission ,need of inotropes and mechanical ventilation was significantly associated with poor outcome and well correlated with PRISM III-24 score. High PRISM III -24 score, MODS on admission ,mechanical ventilation and need of inotropes are independant predictors for PICU mortality.

Keywords: Mortality**,** PRISM III Score, MODS, PICU.

Introduction

Pediatric intensive care units (PICU) aim at promoting quality care with the object of achieving the best results and better prognosis for critically ill children.[1] At admission it is difficult to establish clinical and laboratorial criteria that allow an estimative of the number and intensity of organ dysfunction and need for therapeutic intervention. However, the technology available has not always succeeded in improving the quality of patient care and to augment life expectancy.[2] Thus it became necessary to characterize the disease severity at admission, assessing its prognosis.[3] They are useful for evaluating the quality of care, prognosis, to estimate the risk of mortality and to compare different services according to the complexity of the underlying disease.

Severity of illness is reflected by magnitude of co-morbidities and physiologic disturbances in critically ill children. These disturbances are estimated by measuring how apart the physiologic variables are from the normal range. In context of intensive care, a rational and objective way to define and quantify severity of illness is through the development of probability models predicting mortality risks. Such models will allow increased understanding of the effectiveness of different medical intervention and development of standards that may guide health care providers in optimizing use of available medical resources. Ever since the introduction of mortality scores in the ICU, they have been used more frequently and now days the scores are part of the methodology of quality control and research.[4]

Pediatric Risk of Mortality (PRISM) score is the principal score used in the pediatric population.[5] The purpose of this study was to assess the risk factors contributing to increased mortality in PICU and their association with PRISM III-24 score in PICU like set up in a tertiary care paediatric unit in the Indian circumstances.

Materials and Methods

This was an Observational Prospective study carried out in Pediatric Intensive Care unit (PICU) of Government medical college and hospital Nagpur conducted from October 2014 to October 2016. Study Population included all the children who were admitted in PICU between 1 month to 12 years of age .Exclusion Criteria being patients staying less than 24 hours or died within 10 hours of PICU admission and patients with history of trauma ,burn and surgical problem. Patients who do not give consent to participate in the study and decide to opt out of the study. The study was conducted after taking Institutional Ethics Committee approval .All the cases admitted to the PICU who satisfied the inclusion criteria are included for the study. Following admission a detailed history and written informed consent will be taken, followed by thorough general and systemic examination will be done. Causes of PICU admission have been categorized on the basis of various risk factors considered as clinical variables associated with outcome. These were GCS score ≤ 8, presence of MODS on admission (MODS ,Defined as involvement of two or more organ),need of mechanical ventilation ,need renal replacement therapy,need ionotropes and duration of hospital stay. The PRISM III scores were applied for every patient at the time of admission and recorded then their hospital course was followed to determine the outcome of their sickness (as discharge or death).The association of PRISM-III Score ,GCS score, MODS, Mechanical ventilation ,renal replacement therapy,length of hospital stay and need of inotrops with the outcome (discharge or death) was tested using the Chi–square.. Univariate linear regression of the association between risk factors and PRISM III score. Multiple logistic regression analysis was used for independent predictors for PICU mortality. The statistical software MS EXCEL and SPSS 16.0 version were used for all analyses.

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Result

Out of 200 patients studied ,115 were male patients out of which 23 expired i.e. 51.1% of total death. 85 were female patients out of which 22 patients expired i.e. 48.9% of total death. Out of total 200 patients 155 (77.5%) were discharged and 45 patients expired. The overall mortality was 22.5%.

Table 1: Age group distribution and outcome

Age group	Outcome				Total No (%)
	Discharge		Death		
	No	%	No	%	
< 1 year	55	35.5%	10	22.2%	65(32.5%)
1- 3 years	32	20.6%	14	31.1%	46(23%)
3 -5 years	28	18.1%	6	13.33%	34(17%)
5-12 years	40	25.8%	15	33.33%	55(27.5%)
Total	155	100%	45	100%	200(100%)

Pearson Chi square=4.726, p value=0.193

Table 1 shows distribution of age among discharged and expired patients and association with outcome. A total of 65(32.5%) patients are less than 1 year of age with survival rate of 35.5%. For age group between 1 to 3 years, total 46(23%) were admitted and survival rate of 20.6%.For age group between 3 to 5 years survival rate is 18.1%for total of 34 patients(17%). For age group 5 to 12 years survival rate is 25.8% for total admitted of 55(27.5%) patients.

The mean age of survival is 3.8±3.76 years whereas non survival is 4.49±3.82 years After use of chi square test to find out p value which comes to be 0.193,it proves that no significant association exists between age of patient and the outcome.

Table 2: Association between Primary system involved and outcome

Primary System involved	Outcome				Total No (%)
	Discharge		Death		
	No	%	No	%	
CNS	40	25.8%	7	15.6%	47(23.5%)
RS	40	25.8%	4	8.9%	44(22.0%)
Multisystem Involvement	22	14.2%	9	20.0%	31(15%)
CVS	14	9.0%	4	8.9%	18(9.0%)
Haematological	8	5.2%	10	22.2%	18(9.0%)
Renal	14	9.0%	2	4.4%	16(8.0%)
Hepatobiliary	3	1.9%	6	13.3%	9(4.5%)
Endocrine	6	3.9%	0	0.0%	6(3.0%)
Others(Poisonings,Snake Bite)	8	5.2%	3	6.7%	11(5.5%)
Total	155	100%	45	100%	200(100%)

Table 2 represents the number of patients admitted with respect to their primary organ involvement. CNS(n=47) is the most common system involved with associated mortality rate of 15.6% followed by respiratory system (n=44) with mortality rate of 8.9%. Maximum numbers of death were reported in haematological (22.2%) and multisystem involvement (20.2%).

Based on observed PRISM III score all subjects were distributed into four groups as shown in table 1.127 patients have PRISM III score ranging from 0-9,where 53 patients with score 10 to 19,14 patients with the score between 20-29 and only 6 patients between score 30 and above.

The survival rate was 96.1% in first group (PRISM III score 0-9), 52.9% in second group (score10-19), 28.5% in third group (score 20-29) and 16.7% in the fourth group (score ≥ 30).

The proportion of death which was only 4% among children with PRISM III score of 0-9,showed gradual increase with higher score reaching 83.3% among the children with PRISM III score 30 and above. This clearly shows that with increase in PRISM III score there is significant increase in mortality.

The mean PRISM III score among the survival is 5.76±6.122 and among non survival is 17.55±7.418.The PRISM III score show highly significant correlation with outcome (p<0.001).In patients with length of hospital 1-3 days, survival rate of 10.3%, between 4-7 days survival rate of 56.8% and for 8-15 days survival rate of 23.9%. There is only 11.1% death among length of hospital stay more than 15.

Table 3: Association of various Clinical variables and outcome

Parameters		No. of Cases	Discharge		Death		p-value
			No	%	No	%	
GCS Score	≤8	39	17	0.43%	22	56.4%	Chi2=31.9482
	>8	161	138	85.7%	23	14.2%	P<0.001
MODS	Yes	36	13	36.1%	23	63.8%	Chi2=43.1293
	No	164	142	86.5%	22	13.4%	P<0.001
Mechanical ventilator	Yes	62	32	51.6%	30	48.3%	Chi2=34.5323
	No	138	123	89.1%	15	10.9%	P<0.001
Renal replacement therapy	Yes	14	12	85.7%	2	14.3%	Chi2=0.5825
	No	186	143	76.9%	43	23.1%	P=0.740
Need of inotrops	Yes	52	25	48.1%	27	51.9%	Chi2=34.8870
	No	148	130	87.8%	18	13.8%	P<0.001

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Table no 3 shows the causes of PICU admission have been categorized on the basis of the various risk factors which are considered as clinical variables associated with outcome. Out of total 200 patients majority 62 patients were admitted for need of mechanical ventilation ,with mortality of 48.3%(p<0.001),52 patients were admitted for need of inotropes with mortality of 51.9%(p value<0.001),39 were admitted with GCS score≤8 and mortality of 56.4%(p value<0.001) ,where 36 patients were admitted with MODS on admission and mortality 63.8%(p value<0.001).Only 14 patients were indicated renal replacement therapy with mortality 14.3%(p value = 0.74). This shows that presence of GCS score ≤ 8,MODS on admission ,need of inotropes and mechanical ventilation was significantly associated with poor outcome.
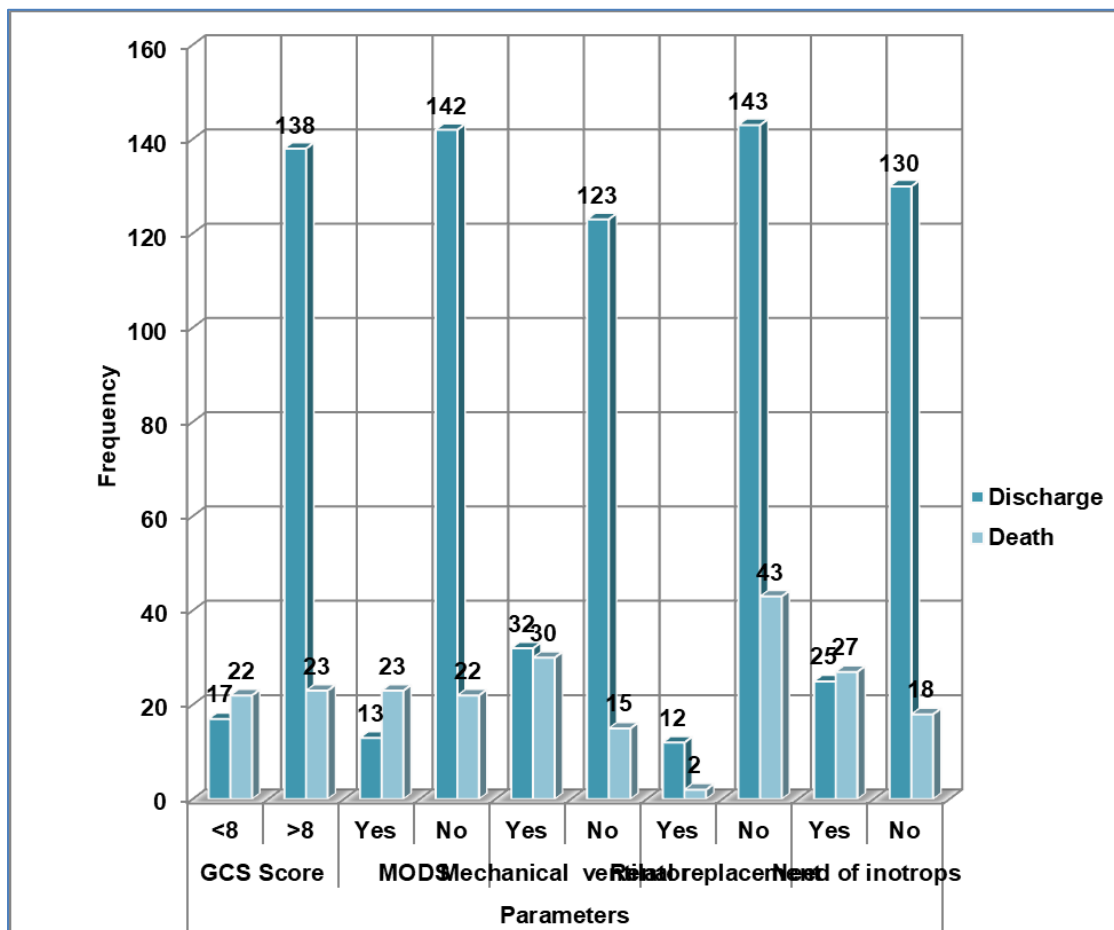

Fig 1: Association of various Clinical variables and outcome

Table 4: Univariate linear regression of the association between risk factors and PRISM III score

Variables	Coefficients(a)						
	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B	
	B	Std. Error	Beta	t	Sig.(p)	Lower Bound	Upper Bound
(Constant)	35.538	2.033		17.485	0	31.53	39.547
MODS on admission	-2.044	0.976	-0.097	-2.095	0.037	-3.968	-0.119
Mechanical ventilation	-4.323	0.912	-0.248	-4.74	0	-6.121	-2.524
Inotrops	-7.467	0.857	-0.406	-8.716	0	-9.157	-5.777
Renal replacement therapy	-6.99	1.401	-0.221	-4.991	0	-9.752	-4.227
Length of hospital stay	0.099	0.054	0.082	1.849	0.066	-0.007	0.205
GCS score <8	-0.916	0.108	-0.447	-8.481	0	-1.129	-0.703

Table no 4 shows association between various risk factors and PRISM III score done by Univariate Linear regression. MODS on admission (p <0.037),GCS score ≤ 8 (p<0.001),Mechanical ventilation(p<0.001),need of inotrops (p<0.001),renal replacement(p value<0.001) were significantly corelated with PRISM III score. While, length of hospital stay (p =0.066) was not corelated with PRISM III score.

Table 5: Multiple logistic regression analysis for independent predictors of PICU mortality

Parameter	Adj OR	95% C.I.	p-value
GCS score	0.85	0.16 – 4.59	0.857
PRISM-III Score	1.18	1.07 – 1.29	0.001
MODS on admission	9.05	2.92 – 27.97	<0.001
Mech.Ventilator	4.96	1.22 – 20.04	0.025
Need of Inotrops	3.35	1.04 – 10.74	0.042
Length of Hospital stay	0.99	0.92 – 1.06	0.820

Table 5 shows multiple logistic regression analysis for independant factors .This shows PRISM III score (p value=0.001),MODS on admission (p<0.001) ,Mechanical ventilation (p=0.025) and need of inotropes (p=0.042) were significantly associated with the mortality on Multiple logistic Regression analysis for independent predictor. Length of hospital stay (p value=0.820) and GCS score ≤8 were not significant independent predictors for PICU mortality.

Discussion
In the present study, demographic profile like age of patients (p value=0.07) and gender of patients did not show any significant correlation with the outcome. A similar observations was also found in other Indian studies Thukral [6] et al 2006, Singhal [7]et al, Karambelkar[8] et al and Khilnani[9]P 2004.
In the present study, the observed mortality rate was 22.5% which was comparable to other centers in India. In the study by Taori[10]et al done in 2009 at KEM Hospital, Mumbai it was 24.3%. The major causes of illness in the study are Central nervous system (CNS) disorders, Respiratory disorders, Cardiovascular system (CVS) , Renal, Hematological and multisystem involvement. In present study, the most common cause of admission in our PICU was central nervous system diseases. This was in contrast to that in the studies conducted by Singhal [10]et al and Khilnani [9]et al in which respiratory failure was the most common cause of PICU admission. This difference may be due to different demographic profile of the studies.
In present study the mean length of hospital stay was 8.00± 6.07 days among survivors and 7.62±8.49 days among non survivors. The mean length of hospital stay was more in survivors patients. This was statically significant, p value being 0.0125. Similar observation were noted in Bellad et al[11] where mean length of hospital stay was more in survivors.(6.5±3.4 vs 3.3±3.1 in non survivors p<0.001).
Our observation , that increase in PRISM III SCORE is associated with an increase in the mortality, showing a significantly positive co-relation with the outcome. A similar observations was also found in other Indian studies Taori[10]et al and Das [12]et al.In the present study shows MODS on admission was identified as a significant risk factor for death. Univariate linear regression analysis showed that MODS was significantly associated with PRISM III score of poor outcome (high mortality) as also found in Bellad[11] et al, Costa GA et al[2] studies.
In the present study, mechanical ventilation and need of inotropes had a significant influence on the outcome of the patients in the PICU among non survivors .Similar observation were noted in other studies Tan GH et al[13]and Aragao RCF et al.[14] In the present study need of renal replacement was not significantly associated with outcome as p value 0.74.similar observation were noted in Ali M et al.[15] Univariate linear regression analysis showed that need of renal replacement was significantly associated with PRISM III score as also found in study done by TanGH et al.[13]
In present study Univariate linear regression analysis showed that length of hospital was not associated with PRISM III score . On contrast study by Costa GA et al[2] noted that length of hospital stay was associated with PRISM III score on univariate linear regression analysis.
In present study GCS score ≤ 8 was significantly associated with mortality. Similar observation noted in Das[12]et al. Univariate

linear regression analysis showed that GCS ≤ 8 was associated with PRISM III score.
In present study on multivariate logistic regression showed that MODS on admission ,mechanical ventilation and need of inortopes are significantly associated with the mortality for independent predictors of PICU mortality. Length of hospital stay was not an independent predictor of PICU mortality. Similar observation noted in study by Williams et al[16] showed that in intensive care unit, the duration of hospitalization is not an independent risk factor for mortality.
High PRISM III score was significantly associated with the poor outcome i.e. death in this study. As the PRISM III score increases the mortality in PICU increases .The best indicators of poor outcome in our study were high PRISM III score ,MODS on admission ,need of mechanical ventilation, need of inotropes and the length of hospital stay .The strength of this study is large cohort and prospective in nature.

Conclusion
Clinical variables such as MODS on admission ,mechanical ventilation ,need of inotropes ,renal replacement therapy and GCS score≤ 8 well corelated with PRISM III score. PRISM III score, MODS on admission ,mechanical ventilation and need of inotropes are independant predictors for PICU mortality. The best indicators of poor outcome in our study were high PRISM III score ,MODS on admission ,need of mechanical ventilation, need of inotropes and the length of hospital stay.

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