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A Study To Assess The Role Of pSOFA-L Score In Predicting The Clinical Outcome Of Critically Ill Children Admitted To The Pediatric Intensive Care Unit (PICU) At A Tertiary Care Centre

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ABSTRACT
Background: This study was aimed to evaluate the role of the recently adapted and validated Pediatric Sequential Organ Failure Assessment (pSOFA) score in predicting the clinical outcome of critically ill children in a tertiary care centre. We also assess the relationship of serum lactate levels with the SOFA score, hence using the pSOFA-L score in predicting the clinical outcome better in critically ill children.
Methods: This hospital based prospective, observational, descriptive study was conducted in the Department of Paediatrics, Sir Padampat Institute of Neonatal and Child Health, SMS Medical College, Jaipur, Rajasthan. A total of 100 cases were studied. Parameters pertaining to the various organ systems as designated in the SOFA score were studied and compared the score with the clinical outcome.
Results: In this study there were 56 survivors and 44 non survivors. On ROC Curve analysis, the cut off value of pSOFA-L score in predicting the mortality was 10 with a sensitivity of 81.8% and specificity of 85.7 % and AUC:0.882 , which is statistically significant($p<0.001$). In the present study mortality rate was 11.3 % in children whose pSOFA-L score was less than 9 and mortality rate of 18.2 % and 70.5 % in children whose pSOFA-L score was 9 to 11 and more than 11 respectively. On bivariate analysis of the survivor and non-survivor group, the difference in mean pSOFA-L score was strongly statistically significant (p value: 0.000). Non survivors had a significantly higher score. The mean lactate level in the survivor group was 1.75 1.19 and in the non-survivor group it was 3.02 ± 1.59. This difference was strongly statistically significant. (p value : 0.000).
Conclusions: In this study increase in pSOFA-L score is associated with high mortality and poor outcome. The findings of the present study validate and emphasize the role of pSOFA-L score in accurate prediction of mortality of critically ill children.

Keywords: Multi Organ Dysfunction Syndrome, Pediatric Sequential Organ Failure assessment, PELOD Score, pSOFA-L score

I. INTRODUCTION

With progress in all specialities in Pediatrics, pediatric critical care has also developed tremendously. Nowadays Pediatric intensive care units are becoming increasingly sophisticated in terms of equipment used and the types of therapy administered in various acute illnesses. The evaluation and prognostication of all cases admitted to the Pediatric Intensive Care Unit (PICU) is important for standardisation and documentation. Scoring systems aim 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. The outcome of pediatric intensive care has not been widely reported in India and few studies describe the use and validation of any scoring system. Almost all patients in intensive care units (ICUs) have some organ dysfunction. Adult and pediatric studies have shown that mortality increases with the number of organs involved. Thus, multiple organ dysfunction syndrome (dysfunction involving two or more organs) has been viewed as the inevitable pathway to death.

Clinical opinions are more of subjective whereas predictive scoring systems appear to be objective method of assessment. Many Predictors of Mortality Scores exist such as SOFA, PELOD and PRISM-III. The Sequential Organ Failure Assessment (SOFA) score was selected as the scoring system to quantify organ dysfunction in the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) [(1)]

TheSepsis-3 Task Force validated the SOFA score in adult patients with suspected infection and found the SOFA system to be either comparable or superior to other scoring systems at discriminating in-hospital mortality.

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The Sepsis-3 definitions are expected to be widely adopted and, by extension, the use of SOFA score in patients with confirmed or suspected infection.

One of the major limitations of the SOFA score is that it was developed for adult patients and contains measures that vary significantly with age, which makes it unsuitable for children. The Sepsis-3 Task Force recognized this problem and identified it as an area for further development.

Prior studies have attempted to adapt the SOFA score to pediatric patients, mostly focusing on the cardiovascular sub score. However, none have taken into account the age related variability of the renal sub score criteria despite the increasingly recognized detrimental effect of kidney dysfunction in younger patients [4-6]

In addition, the respiratory sub score criteria—based on the ratio of PaO2 to the fraction of inspired oxygen (FiO2)—have not been modified in previous adaptations of the SOFA score even though the decreased use of arterial blood gases in children is a known limitation. Fortunately, the cardiovascular and renal components of the SOFA score were evaluated and adapted to pediatric patients by the PELOD-2 score investigators, and the ratio of peripheral oxygen saturation (SpO2) to FiO2 has been validated as an alternative to the PaO2:FiO2 ratio in children[3].

In this study, we sought to adapt and validate a SOFA score for critically ill pediatric patients (pSOFA) using age-adjusted criteria. Multiple organ failure, which can occur in many severe conditions, including trauma, sepsis, burns and severe acute pancreatitis, is an important cause of morbidity and mortality.

Blood lactate levels have been associated with the occurrence of organ failure. However, the relationship between lactate levels and the well-validated Sequential Organ Failure Assessment (SOFA) score has not yet been studied in children.[7] Although lactate as a biomarker and SOFA as an organ dysfunction scale have different functions, an association between the two might have clinical implications. Blood lactate measurement may act as a real-time marker for the severity of organ failure whereas calculating the SOFA score takes 24 hours. [8]This might improve therapy by adapting resuscitation to serial lactate measurements, which might prevent organ failure and eventually improve clinical outcome. Because the SOFA score comprises scores from six different organ systems, it is also possible to evaluate the association of lactate with separate organ systems. In view of this we decided to evaluate the paediatric version of SOFA-LACTATE [pSOFA-L] score in predicting the mortality of critically ill children in our set up .

Blood lactate levels are strongly related to SOFA scores. This relationship is stronger during the early phase of intensive care unit stay, which provides additional indirect support for early resuscitation to prevent organ failure. The results confirm that hyperlactatemia can be considered as a warning signal for organ failure [9]

In a tertiary care centre like SPINCH, JAIPUR, it is of utmost importance to create a standardised scoring system for prognostication of all the cases admitted to ICU and correlate it with the mortality and morbidity of the cases.

II. MATERIAL AND METHODS

This is hospital based observational descriptive study conducted at Pediatric Medicine Department of Sir Padampat Institute of Neonatal and Child Health, SMS Medical College, Jaipur. The study universe was all critically ill children admitted to the Pediatric Intensive Care Unit. On fulfilment of inclusion and exclusion criteria and obtaining informed consent, 100 patients were enrolled in the study. PSOFA-L score was used to predict the outcome of the patients. This includes 7 variables namely Glasgow Coma scale, blood pressure, PaO2, Fio2, SPO2, platelet count, bilirubin levels, serum creatinine and lactate levels. For each variable, the most abnormal value of that day is used in calculating the PSOFA-L score. Again the score was measured at 72 hours post admission to the ICU. Other factors such as age and sex distribution of the patients, total counts, mode of transport were also documented.

INCLUSION CRITERIA

- Children between the age of 1 month to 18 years admitted to PICU.
- PICU stay more than 48 hours.
- Presence of paediatric MODS [>1 organ system failure] irrespective of the cause.

EXCLUSION CRITERIA

- Admission for scheduled procedures normally cared for in a PICU [eg.Hemodialysis, IVIG administration.]
- PICU stay less than 48 hours.

ETHICAL CLEARANCE

1 The study was commenced after approval from research review board and institutional ethics committee of SMS Medical College, Jaipur, Rajasthan.

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2. Informed consent was taken from parent/attendant in a predesigned informed consent format.

III. DATA ANALYSIS

The data was entered in Microsoft Office Excel worksheet. Qualitative data was presented in numbers and percentage while quantitative data was presented in mean and standard deviation. Data collected was compiled in MS Excel spread sheet as master chart. Data was presented as tables, figures and charts.

Nominal / categorical variables were summarized as frequency and percentage and were analysed using Chi square test.

Continuous variables were summarized as mean and standard deviation and were analysed using independent sample t test for comparison between 2 groups.

ROC curve was drawn to evaluate pSOFA-L for predicting mortality. Area under the curve (AUC) was calculated along with its 95% confidence interval and Youdens index was used to determine the critical cut-off value of pSOFA. Sensitivity, specificity, positive and negative predictive value and diagnostic accuracy were calculated at this critical cut-off values.

A p value $\leq$ 0.05 was taken as statistically significant.

All statistical analyses was done using 'Epi info' version 7.2.1.0 and 'open Epi' version 3 statistical software.

Receiver Operating Characteristics (ROC) curve analysis will be used to estimate the cutoff value of Pediatric Sequential Organ Failure Assessment score-Lactate (PSOFA-L) in determining the outcome of the patient.

TABLE 1: PEDIATRIC SEQUENTIAL ORGAN FAILURE ASSESSMENT –LACTATE SCORE

Variables		Score 0	1	2	3	4
Respiratory	PaO_2:FiO_2 or	≥400	300-399	200-299	100-199 with respiratory support	<100 with respiratory support
	SpO2:FiO_2	≥292	100-149	50-99	20-49	<20
Coagulation	Platelet count ($x10^3$ /µL)	≥150	100-149	50-99	20-49	<20
Hepatic	Total bilirubin (mg/dL)	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular - MAP by age group or vasoactive infusion, mmHg or µg/kg/mind	<1 mo	≥46	<46	Dopamine hydrochloride ≤5 or dobutamine hydrochloride (any)	Dopamine hydrochloride >5or epinephrine ≤0.1or norepinephrine bitartrate ≤0.1	Dopamine hydrochloride >15or epinephrine >0.1or norepinephrine bitartrate >0.1
	1-11 mo	≥55	<55			
	12-23 mo	≥60	<60			
	24-59 mo	≥62	<62			
	60-143 mo	≥65	<65			
	144-216 mo	≥67	<67			
	>216 mo	≥70	<70			
Neurologic	Glassgow coms score	15	13-14	10-12	6-9	<6
Renal - Creatinine by age group	<1 mo	<0.8	0.8-0.9	1.0-1.1	1.2-1.5	≥1.6
	1-11 mo	<0.3	0.3-04	0.5-0.7	0.8-1.1	≥1.2
	12-23 mo	<0.4	0.4-0.5	0.6-1.0	1.1-1.4	≥1.5
	24-59 mo	<0.6	0.6-0.8	0.9-1.5	1.6-2.2	≥2.3
	60-143 mo	<0.7	0.7-1.0	1.1-1.7	1.8-2.5	≥2.6
	144-216 mo	<1.0	1.0-1.6	1.7-2.8	2.9-4.1	≥4.2
	>216 mo	<1.2	1.2-1.9	2.0-3.4	3.5-4.9	≥5
Lactate level		<2 mmol/	>2 mmol/lt			

IV. RESULTS

TABLE 2-CLINICAL PROFILE OF THE STUDY POPULATION

	MEAN		**MEDIAN**	**RANGE**		
	Mean(n=100)	**SD**	**Median**	**Minimum**	**maximum**	**P value**
Age (months)	48.86	62.39	13.5	1	192	
MAP (mmHg)	40.67	17.88	34	16	110	**0.018 (S)**
TC	14.21	8.28	13.1	1.26	51	**0.029 (S)**

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($x10^3$/dl)						
Platelet count ($x10^6$)	3.08	2.12	2.7	0.18	14	**0.043 (S)**
Total bilirubin (mg/dl)	1.07	1.25	0.7	0.2	7.1	0.410
Creatinine (mg/dl)	0.96	2.5	0.92	0.3	24	0.186
FIO2	0.53	0.56	0.6	0.21	3	0.166
GCS	10.11	2.59	10	2	15	0.143
Dopamine (µg/kg/min)	6.95	5.41	10	0	15	
Dobutamine (µg/kg/min)	2.3	4.46	0	0	15	
Adrenaline (µg/kg/min)	0.06	0.24	0	0	1	
Length of hospital stay(days)	10.47	8.1	8	3	43	
pSOFA-L score	9.1	3.30	9.1	0	17	

The clinical profile of the study population is as shown in Table 2. Age of the study population ranged between 1 and 192 months. The mean age was 48.86 ± 62.39 months and median was 13.5 months,

The mean PSOFA-L score was 9.1±3.30 with a median score of 9.1.
The score ranged from 0.00 to 17.00 in the study population.

OUTCOME IN RELATION TO GENDER OF STUDY SUBJECTS

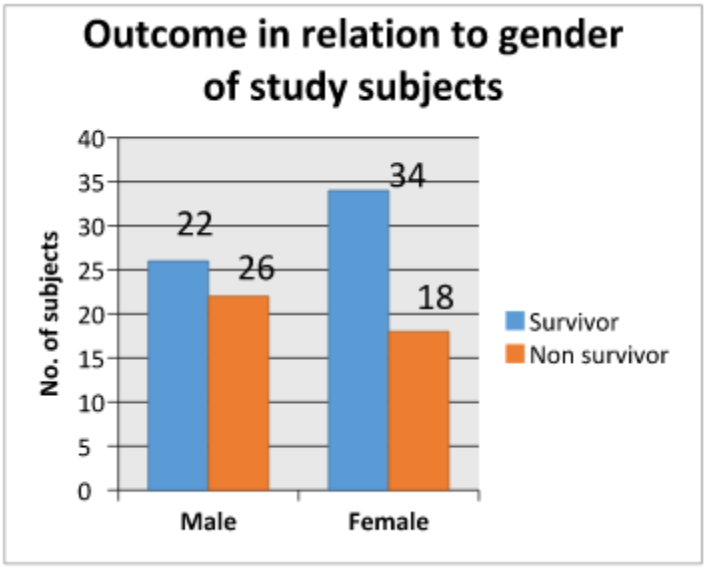

Figure 1: Comparison of children according to sex and its association with outcome

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It was observed that out of 48 (48 %) male children, 22(45 %) survived and 26 (55 %) expired. Among 52 girls (52%), 34 (65 %) survived and 18 (35 %) expired. This was statistically not significant (p value: 0.347) so in this study there is no association between mortality and gender. (Figure 1)

OUTCOME IN RELATION TO AGE OF STUDY SUBJECTS

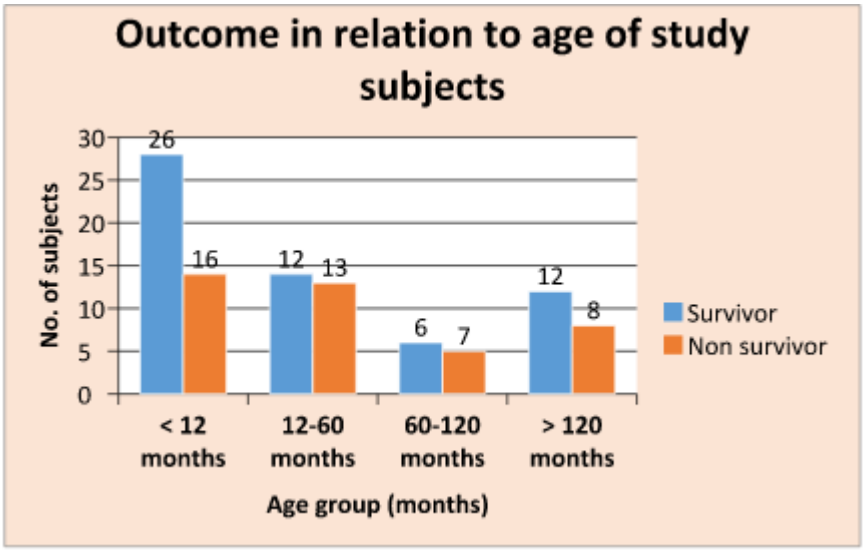

Figure 2: Comparison of age and outcome in the study population

It was observed that majority of children included in the study population were less than 12 months (42 %). Mortality rate was highest in children aged 60-120 months (54 %) and survival rate was higher in children <12 months (61 %). However no statistically significant correlation was seen between mortality and age of the patient (p value: 0.884), so all the children are equally vulnerable irrespective of age.

COMPARISON OF THE SURVIVOR AND NON SURVIVOR GROUP ON ALL THE PARAMETERS AND CHARACTERISTICS USING A BIVARIATE ANALYSIS

Test used: Unpaired t test

p- Value <0.05 considered statistically significant.

TABLE 3- Comparison of the survivor and non-survivor group using a bivariate analysis

Characteristics	**Survival group (N=56)**	**Non-Survival (N=44)**	**p-Value**
Age	46.29±61.86	52.14±63.61	0.644
Sex			
Male	25 (44.6%)	23 (52.3%)	0.546
Female	31 (55.4%)	21 (47.7%)	
Dopamine (µg/kg/min)	5.09±5.35	9.32±4.52	0.000
Dobutamine (µg/kg/min)	1.07±3.26	3.86±5.27	0.002
Adrenaline (µg/kg/min)	0.04±0.19	0.09±0.29	0.253
Mean Arterial Pressure(mmHg)*	54.38±14.09	44.45±17.20	0.002
Platelet count($x10^6$)*	2.63±1.38	1.80±1.39	0.004
Serum bilirubin(mg/dl)*	0.65±0.79	1.48±1.93	0.005
Serum creatinine (mg/dl)*	0.78±1.68	0.82±0.81	0.896
FIO2*	0.23±0.43	0.68±0.47	0.000
GCS*	10.80±2.70	7.00±2.94	0.000
Lactate*	1.75±1.19	3.02±1.59	0.000
pSOFA-L Score*	7.38±3.30	12.95±3.52	0.000
Duration of hospital stay (days)	10.59±7.00	10.32±9.39	0.869

*Values used are at 72 hours post admission to PICU

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It was observed that the Mean arterial pressure, Platelet count, FiO2 requirement, Serum bilirubin, Glasgow Coma Score, Serum Lactate levels and pSOFA-L score in the survivor and non-survivor group had statistically significant difference. (p value <0.05) at 72 hours after admission to the PICU. This reinforces the ability of PSOFA-L score in prognosticating the cases and providing an objective measure to predict the clinical outcome of the cases.

COMPARISON OF pSOFA-L SCORE WITH MORTALITY

Test used: Chi square test

PSOFA-L score <9 was associated with mortality rate of 11.3 % in comparison to 18.2 % with a PSOFA-L score of 9-11 and 70.5% mortality with a score of >11, which was statistically significant (p <0.001)(table-4)

Higher the pSOFA-L score, worse was the prognosis.

TABLE 4: COMPARISON OF pSOFA-L SCORE WITH MORTALITY

pSOFA-L score	**Survivor**		**Non-Survivor**		**Total**
	N	**%**	**N**	**%**	
< 9	39	69.6	5	11.3	44
9-11	11	19.6	8	18.2	19
> 11	6	10.7	31	70.5	37
Total	56	100	44	100	100

Chi-square = 42.82 with 2 degrees of freedom; **P < 0.001 (S)**

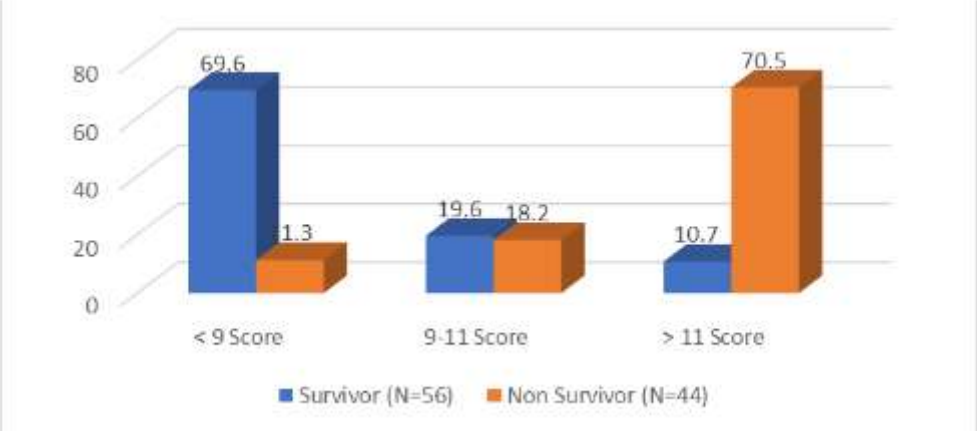

FIGURE 3 : COMPARISON OF PSOFA-L SCORE WITH MORTALITY

COMPARISON OF LACTATE LEVELS WITH MORTALITY

(p value calculated using independent sample t test.)

In this study, at 72 hours post admission the mean lactate levels in survivors was 1.75 ±1.19 umol/l. The mean lactate levels in non-survivors was 3.02 ±1.59. The P value was <0.001 which was strongly statistically significant. Hence increase in lactate levels is associated with higher risk of mortality.(table 5)

Table 5 : Lactate levels in relation to outcome of study subjects

	Survivor (N=56)	**Non Survivor (N=44)**	**P value**
At admission	2.25 ± 1.13	2.52 ± 1.35	0.276
After 72 hours	1.75 ± 1.19	3.02 ± 1.59	**<0.001 (S)**

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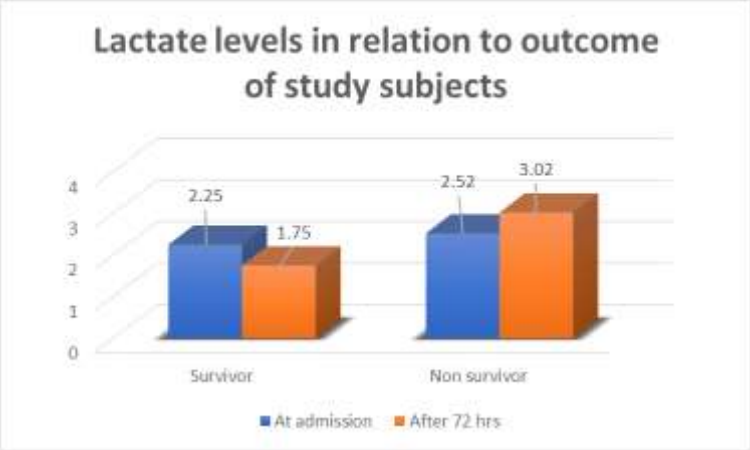
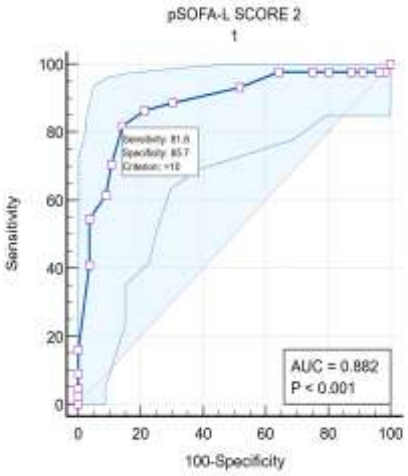
Figure 4 : Lactate levels in relation to outcome of study subjects



ROC Curve of PSOFA-L score in predicting mortality

In the present study ROC Curve yielded AUC of 0.882 and cut off value =10 in predicting the mortality for pSOFA-L score with sensitivity of 81.8 % and specificity of 85.7% which is statistically significant (p value<0.001). This study shows that the pSOFA-L score is a better objective assessment in predicting the mortality. (Figure 5)

Figure 5 : ROC Curve of PSOFA-L score in predicting mortality



ANALYSIS OF CHARACTERISTICS OF STUDY POPULATION BASED ON CUT OFF VALUE OF PSOFA-L SCORE DERIVED FROM ROC CURVE ANALYSIS

Test used: Unpaired students t test

The MAP, Platelet count, Fio2 requirement, GCS, Serum Lactate levels in the 2 groups, with PSOFA-L score <10 and </=10 respectively showed statistically significant difference (p value<0.05).(table-6)

The group with score > 10 had higher sub-scores as compared to the group with PSOFA-L score <10. This indicates that every component of the PSOFA-L score is vital and overall gives a comprehensive way to assess the outcome.

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TABLE 6: CHARACTERISTICS OF STUDY POPULATION BASED ON CUT OFF VALUE OF PSOFA-L SCORE DERIVED FROM ROC CURVE ANALYSIS

Characteristics	pSOFA Score at 72 hour		**p-Value**
	<10 N=50	≥10 **N=50**	
Mean Arterial Pressure(mmHg)	55.98±16.22	44.04±14.01	**0.000**
Platelets ($x10^6$)	2.78±1.52	1.71±1.13	**0.000**
Creatinine	0.71±1.73	0.88±0.87	0.548
FIO2	0.20±0.40	0.66±0.48	**0.000**
GCS	11.22±2.45	7.04±2.85	**0.000**
Lactate	1.64±0.98	2.98±1.66	**0.000**

V. DISCUSSION

The study was conducted on critically ill children admitted to the Paediatric Intensive Care Unit of Sir Padampat Institute of Neonatology and Child Health, department of Paediatric medicine, Sawai Man Singh medical college, Jaipur from July 2021 to December 2022. The study was a hospital based observational descriptive study done with an aim to study the role of Paediatric Sequential Organ Failure (PSOFA) score in predicting the clinical outcome of critically ill children admitted to PICU with an objective to find out factors which influence the PSOFA Score. The addition of the parameter lactate was done as blood lactate measurement acts as a real time marker for the severity of organ failure. The relationship between paediatric SOFA score and blood lactate levels have not been extensively studied and hence we carried out this study at our institute.

All critically ill children admitted to the PICU at Sir Padampat Institute of Neonatology and Child Health, Jaipur were enrolled after application of inclusion and exclusion criteria after taking informed consent from the attendant available, in the present study, the data was collected from 100 patients.

A number of scoring systems have been devised for mortality prediction, including the Pediatric Risk of Mortality (PRISM, PRISM III), Pediatric Index of Mortality (PIM and PIM 2) and the Pediatric Logistic Organ Dysfunction score (PELOD) which are validated in different settings. (9-13)

In critically ill children, organ dysfunction assessment helps in predicting outcome and timing of resuscitation. MODS is characterised by physiological dysfunction of two or more organ systems after an acute insult to systemic homeostasis.

Travis J Matics and Sanchez-Pinto, who originally devised the Pediatric SOFA score with age adjusted variables, and conducted retrospective observational cohort study in critically ill children admitted to PICU over a span of 5 years. In this study, daily pSOFA scores were calculated from admission until day 28 of hospitalization, discharge or death. (Whichever came first)Three additional pediatric organ dysfunction scores were calculated for comparison.(1)

Kumbar S and Chandrashekhara then planned to evaluate the feasibility of addition of lactate level parameter to the pediatric version of SOFA score, so as to formulate the pSOFA-L score and to adapt and validate with reference to pSOFA score in predicting the mortality of critically ill children in the PICU, which was first of its kind. (2)

In the present study, there was a wide variation in the clinical presentation and diagnosis. 56 % of the patients recovered while 44 % expired. The mortality rate noted in the present study was high compared to the study by Kumbar S and Chandrashekhara, who reported in hospital mortality rate of 37.3 % and an ICU survival rate of 62.7 %.(2020)(2) The mortality rate reported in the study by Mattics TJ and Sanchez-Pinto LN was 2.6 % (2017)(1) Recently another study from Hyderabad, India reported mortality rate of 2.1% giving an ICU survival rate of 97.9%. A recent study by Rashma RP. et al. (2018) from Kochi, Kerala, India to study the Mortality Rate and Mortality profile of children admitted to the PICU of a tertiary care centre of Kerala and reported mortality rate of 10.58%.(14)The higher mortality rate noted in the present study can be explained by varied selection criteria and different sample size in the different studies.

In the present study there were 52 % females and 48 % males. The ratio of girls to boys was almost equal (1:1.2) suggesting no role of gender in PICU admission. Mortality was high among males (55 %) as compared to females (35%) but the difference was not statistically significant,

suggesting lack of association between mortality and gender. The gender distribution pattern noted in the present study was sharply in agreement with a recent study by Reshma RP et al. (2018) from Kochi, Kerala, India to study the Mortality Rate and Mortality profile of children admitted to the PICU of a tertiary care centre of Kerala and reported 48% of the females and 52% of the males.[14] Similar patterns of the gender distributions were reported by studies from developing countries. With regard to the mortality and gender predilection, the results of the present study were in agreement with a recent study by Mattics TJ and Sanchez-Pinto LN.28 (2017)[1] where no association was found between mortality and sex (p=0.090).

In this study the age of the children ranged between 1-192 months (1 month-16 years). The mortality was highest in the age group of 60-120 months (54%) and lowest in the age group of < 12 months (39 %), but the difference was not statistically significant, suggesting lack of association between age and mortality. A study by Mattics TJ and Sanchez-Pinto LN.28 (2017) reported significantly lower mean age in children who expired compared to those who survived. [1]

In the present study, inotrope administration was noted in 68 % of the subjects.

Mortality (58 %) was significantly high in the subjects on inotrope support. In the study by Kumbar S et al (2020), strikingly similar results were seen with inotrope administration in 77.3 % subjects and a mortality rate of 47.2 % in those on inotrope support.[2]

In the present study serum lactate analysis was done to explore the accuracy in predicting outcome which indicates anaerobic metabolism at tissue level. The mean lactate level in survivors was 1.75 ±1.19umol/l, while the mean lactate level in non survivors was notably higher, i.e. 3.02 ±1.59umol/l. This difference was strongly statistically significant. (p value<0.001). Hence it was observed that a decrease in serum lactate level is associated with better outcome and increase in serum lactate level is associated with higher chance of mortality. A study Prognostic accuracy of serum lactate level, the SOFA score and qSOFA score for mortality among adults with sepsis conducted by Zhiqiang Liu, Zibo et al documented that higher the lactate level poorer the outcome in terms of mortality in sepsis patients.[15] Serum Lactate level is considered as a key tool in assessing the metabolic acidosis, hypoxia at tissue level which is mediated by shock either it can be septic shock or hypovolemic or cardiogenic shock. Increase in lactate levels is associated with multi-organ dysfunction and predicts the outcome in terms of length of hospital stay and mortality.

pSOFA-L score helps in predicting the mortality of critically ill children and timing of intervention or resuscitation. On Receiver Operating Characteristics (ROC) curve analysis, the cut off value of PSOFA-L score in predicting the mortality was 10 with AUC 0.882 and sensitivity of 81.8 % and specificity of 85.7% , and p value <0.001 which is strongly statistically significant. The Mean Arterial Pressure, Platelet count, Serum bilirubin level, GCS score, FIO2 levels and Serum Lactate levels varied significantly in the survivor and non-survivor group. All of them on comparison had significant p values. However, Serum creatinine as a biomarker of renal dysfunction did not vary significantly between the two groups. The results of the present study were consistent with the one carried out by Kumbar et al. where ROC curve for PSOFA-L score had an AUC of 0.925 with sensitivity of 96.428 and specificity of 80.851 and p value <0.001. Overall, this study confirms that addition of lactate to pSOFA score helps in accurate discrimination of mortality in critically ill children. Hence pSOFA-L score can be applied in the PICU settings.

STRENGTH

The strength of the study was that, the scores were calculated from the data available at admission and at 72 hours which reflect the true state of the patient rather than admission scores alone. Lactate levels helps in better assessment of oxygen deprivation at tissue level which adds on to accurate prediction of outcome.

LIMITATIONS

The conclusions drawn from this study were based on the data from a single centre involving relatively a smaller sample which limits it general application to the entire population. Also long term outcome was not considered. The validity of a score need to be observed by a multicentric trial which will allow for larger case mix and hence more representative of an average Indian PICU.

VI. CONCLUSION

The findings of the present study validate and emphasize that, addition of lactate parameter to pSOFA score is highly useful and accurate in discrimination of PICU mortality and morbidity. Hence a pSOFA-L can be applied in the PICU settings more often thus helping us in quick assessment of outcome of the action, intervention and treatment taken up for individual cases.

pSOFA-L score provides an objective assessment of the severity of illness, performed well as a tool to predict mortality in an Indian PICU. Scoring systems with fewer laboratory parameters like pSOFA- L will be more useful in Indian PICU context.

Larger studies are needed to develop/ validate a mortality prediction pSOFA- L for Indian PICU.

This if routinely applied in PICU setting will further guide us in enhancing the quality of treatment modality and a standard comparative tool is anytime preferred over other subjective parameter.

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REFERENCES

[1]. Matics TJ, Sanchez-Pinto LN. Adaptation and validation of a pediatric sequential organ failure assessment score and evaluation of the sepsis-3 definitions in critically ill children. JAMA Pediatr. 2017 Oct 1;171(10):e172352.

[2]. Kumbar s, Chandrashekhara. Assessment of pSOFA-L score in predicting the clinical outcome of critically ill children. Int J Contemp Pediatr 2020;7:925-31.

[3]. Gemke RJ, Bonsel GJ. Effectiveness and efficiency of a Dutch pediatric intensive care unit: validity and application of the Pediatric Risk of Mortality score. Crit Care Med. 1994 Sep;22(9):1477-84.

[4]. Kanter RK, Edge WE, Caldwell CR, Nocera MA, Orr RA. Pediatric mortality probability estimated from pre-ICU severity of illness. Pediatrics. 1997 Jan 1;99(1):59-63.

[5]. Proulx F, Gauthier M, Nadeau D, Lacroix J, Farrell CA. Timing and predictors of death in pediatric patients with multiple organ system failure. Crit Care Med. 1994 Jun;22(6):1025-31.

[6]. Jansen TC, van Bommel J, Woodward R, Mulder PG, Bakker J. Association between blood lactate levels, Sequential Organ Failure Assessment subscores, and 28-day mortality during early and late intensive care unit stay: a retrospective observational study. Crit Care Med. 2009 Aug 1;37(8):2369-74.

[7]. Arif SK, Gaus S, Kasim R. Use of base excess value and the blood lactate level in predicting organ disfunction measured by Sequential Organ Failure Assessment (SOFA) score system: Study in the post trepanation patients with severe traumatic brain injury. Trends Med Res. 2016;11:101-6.

[8]. Rabello Filho R, Rocha LL, Corrêa TD, Pessoa CM, Colombo G, Assuncao MS. Blood lactate levels cutoff and mortality prediction in sepsis-time for a reappraisal? A retrospective cohort study. Shock. 2016 Nov;46(5):480.

[9]. Castello FV, Cassano A, Gregory P, Hammond J. The Pediatric Risk of Mortality (PRISM) Score and Injury Severity Score (ISS) for predicting resource utilization and outcome of intensive care in pediatric trauma. Crit Care Med. 1999;27(5):985-8.

[10]. Balakrishna G, Aitchison T, Hallworth D, Morton NS. Prospective evaluation of Paediatric Risk of Mortality Score. Arch Dis Child. 1992;67(2):196-200.

[11]. Shann F, Pearson G, Slater A, Wilkinson K. Paediatric index of mortality (PIM): a mortality prediction model for children in intensive care. Inten Care Med. 1997 Feb 1;23(2):201-7.

[12]. Leteurtre S, Duhamel A, Salleron J, Grandbastien B, Lacroix J, Leclerc F, et al. PELOD-2: an update of the PEdiatric logistic organ dysfunction score. Critical Care Med. 2013 Jul 1;41(7):1761-73.

[13]. Gogia1 P, Koreti S, Patel G. SOFA (Sequential Organ Failure Assessment) and PELOD (Pediatric Logistic Organ Dysfunction). Scholars J Applied Med Sci. July 2015; 3(4A):1645-8.

[14]. Rashma RP, Remya S, Jayakumar C, Shanavas M, Manu R. 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):13-6.

[15]. Liu Z, Meng Z, Li Y, Zhao J, Wu S, Gou S, et al. Prognostic accuracy of the serum lactate level, the SOFA score and the qSOFA score for mortality among adults with Sepsis. Scand J Trauma, Resusc Emerg Med. 2019 Dec 1;27(1):51.