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Application of Sequential Organ Failure Assessment (Sofa) As Determinant of Outcome in Children with Sepsis Admitted in Picu

Dr. Jenifer Kalam Mazumder[1], Dr. Sujit Nath Choudhury[2]
1. Post Graduate Trainee, 2. Professor and Head of Department, Department of Paediatrics, SMCH

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ABSTRACT :
INTRODUCTION: sepsis is an important cause of paediatric mortality with majority of children dying of multiple organ dysfunction syndrome (MODS) mainly within the initial 48-72 hour of treatment. Evaluation and prognostication of all cases admitted to Paediatric Intensive Care Unit (PICU) is important for which various scoring systems are used in PICU. SOFA score is a scoring system used in PICU which is based on MODS and helps in predicting the outcome in critically ill children.
METHODOLOGY: It was a prospective observational study conducted in PICU of Silchar Medical College , Assam. The study group consisted of 100 patients between the age group of 1m-12yrs admitted with sepsis. Data collected included the demographic, clinical, laboratory and outcome related variables. SOFA score was calculated for all the subjects during the first 24 hrs and 72 hrs and difference between both i.e. delta SOFA was calculated,
RESULTS : majority of admitted patients were males below 1 yr of age with respiratory complaints chiefly. Overall mortality was 20% . The value of pSOFA score was significantly higher among non-survivors than survived cases. Total pSOFA ≥8 in first 24hrs of admission in PICU had highest diagnostic characteristics in prediction of death.
CONCLUSION : Paediatric SOFA score can be used as a reliable prognostic marker to determine the outcome of children with sepsis in PICU.

I. INTRODUCTION

Sepsis and septic shock are leading causes of death worldwide in paediatric population resulting in an estimated 7.5 million deaths annually1. The majority of children who die of sepsis suffer from refractory shock and/or multiple organ dysfunction syndrome, with many deaths occurring within the initial 48–72 hour . Sepsis is one of the greatest world health problems with the prevalence and death rates increasing every year . In Sepsis-3 International Consensus definitions for sepsis and septic shock, sepsis was described as a life-threatening organ dysfunction due to abnormal body response to infection. Score systems for organ dysfunction (qSOFA and SOFA) were introduced making it easier to identify sepsis as a life-threatening disease in adults2.

Being the most vulnerable part of the population, paediatric patients require special attention as sepsis is one of the most common causes of childrens` death due to infection3.

Sepsis survival depends on timely, appropriate and optimal antibacterial treatment.

The evaluation and prognostication of all cases admitted to the Paediatric Intensive Care Unit (PICU) is important for various reasons. Scoring systems aim at providing an objective measure of the severity and hence the prognosis of patients. 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 Sequential Organ Failure Assessment (SOFA), Paediatric Logistic Organ Dysfunction (PELOD) and Paediatric Risk of Mortality-III (PRISM-III)1.

The Sequential Organ Failure Assessment (SOFA) score was developed in 1994 during a consensus conference organized by the European Society of Intensive care and emergency Medicine, in an attempt to provide a means of quantitatively and objectively describing the degree of organ failure over time in patients with sepsis2.

The SOFA score is based on six different independent scores including respiratory, cardiovascular, hepatic, renal, coagulation, and neurological systems each scored from 0 to 4 with an increasing score reflecting worsening organ dysfunction.3,4

Paediatric critical care admissions can be prognosticated as well as risk stratified according to a scoring system which is simple with definite parameters that are easily available, and measured .Thus use of limited financial, medical and human resources can be optimized and will allow the best usage in the ICU. Outcome of children with sepsis

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admitted to PICU, depends on initial as well as sequential organ dysfunction of an individual .

This study has been undertaken in our institution due to paucity of such studies in North East India so that we can generate a base line scoring system for prognostication of sepsis patients for reducing the morbidities and mortality related to sepsis.

II. MATERIALS AND METHODS:

The study conducted is a hospital based observational study conducted in Department of Paediatrics, SILCHAR MEDICAL COLLEGE AND HOSPITAL situated in Assam, India from 1st June 2021- 31st May 2022 in 100 children admitted in PICU during this period.

PROCEDURE: patients included in the study were followed until they were discharged from PICU or deceased. Initial SOFA score was calculated within 24 hours of admission and then was calculated after 72 hours. Delta SOFA score was calculated as the change in SOFA score over 72 hours. In each organ system, the highest score in any variable accounted was taken as the score or the organ system. The sum total of the 6 scores for each organ system gives SOFA score (ranging from 0 to 24) which was used to predict risk of mortality in PICU. The data obtained was coded and entered into Microsoft excel spreadsheet. Categorical data was expressed as rates, ratios and percentages. Blood Investigations were taken under aseptic conditions with adequate care and sent to the hospital 24 hours laboratory immediately. All the investigations were done in our hospital and no investigations or procedures were done outside the hospital. Any experimental or so far unused materials or methods were not used on the patients.

III. RESULTS AND OBSERVATIONS

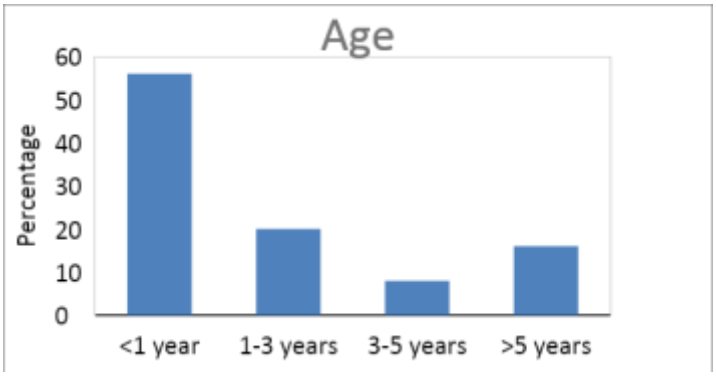

FIGURE 1: AGE DISTRIBUTION OF STUDY POPULATION

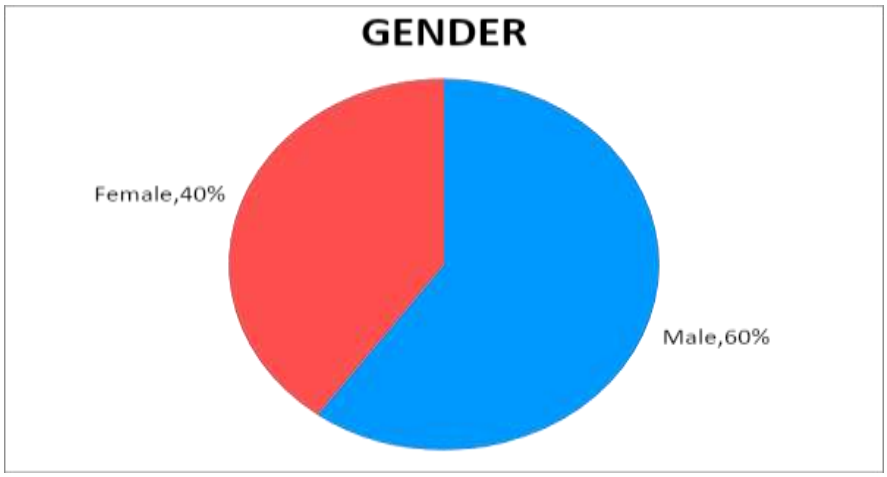

FIGURE 2: Pie diagram showing gender distribution in the study population.

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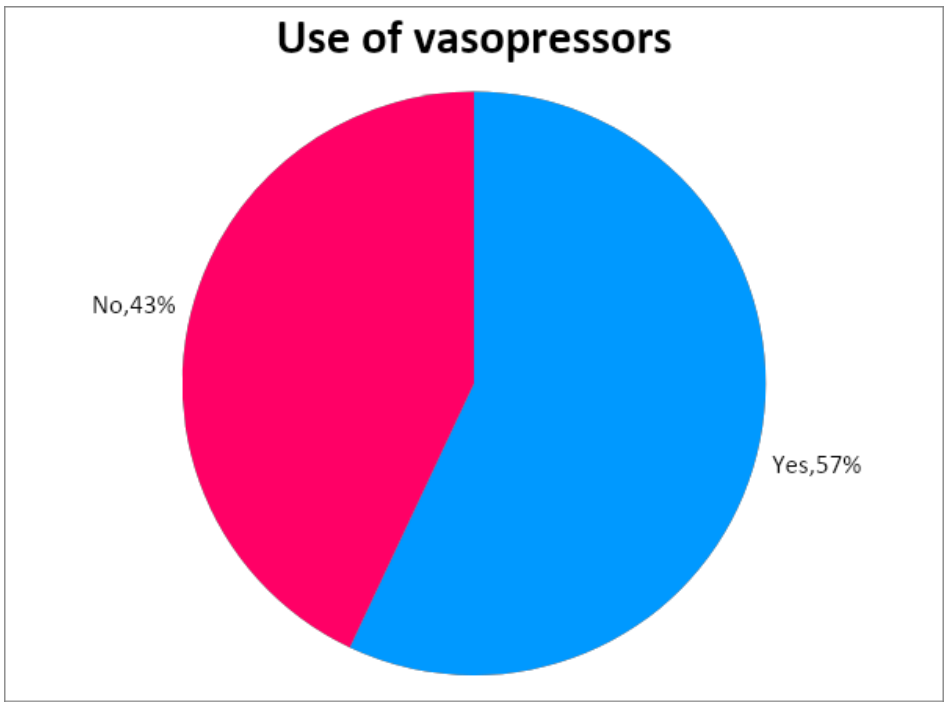

Figure 3: Pie diagram showing use of vasopressors in our study population.

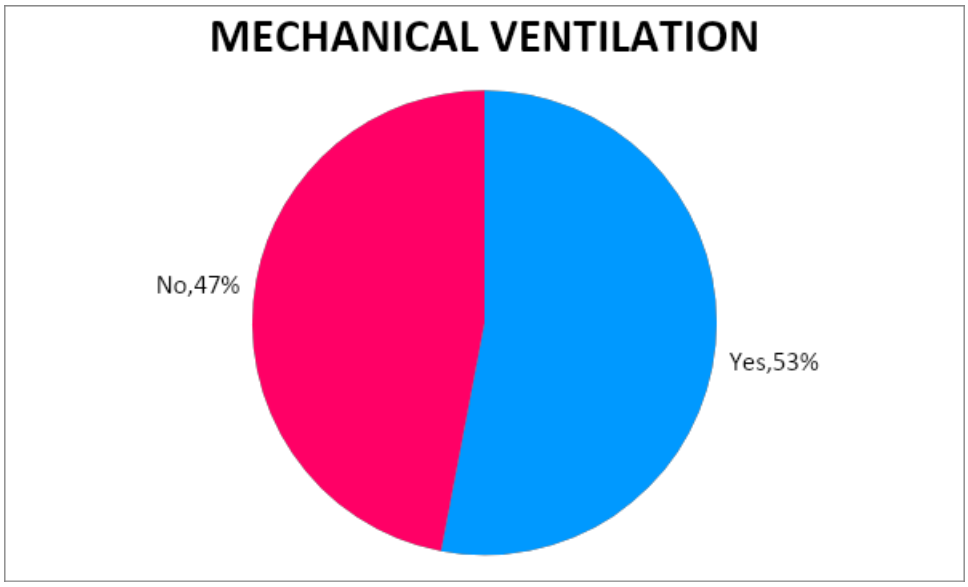

FIGURE 4 : Pie diagram showing use of mechanical ventilators in study population.

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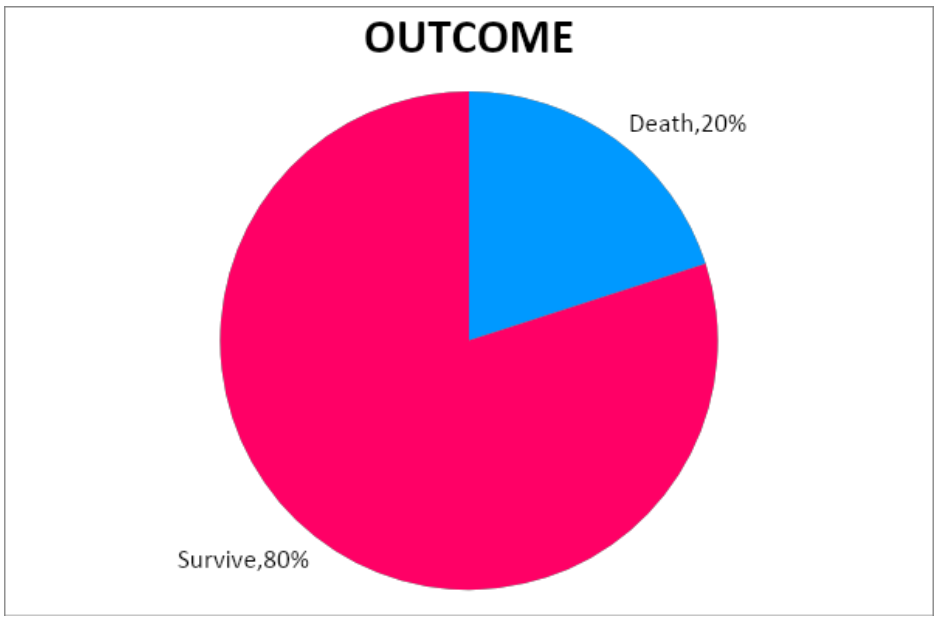

FIGURE 5: Pie diagram showing death and survival in study population.

Use of vasopressors	Death		Survive		Total		χ^2	Df	P
	N	%	N	%	N	%			
Yes	19	33.3	38	66.7	57	100			
No	1	2.3	42	97.7	43	100	14.73	1	<0.001
Total	20	20	80	80	100	100			

TABLE 1 : among 100 total subjects, vasopressors were used in 57 subjects out of which 19 expired (33.3%) and 38 survived (66.7%) with a p value of <0.001 which is statistically significant.

MECHANICAL VENTILATION	Death		Survive		Total		χ^2	Df	P
	N	%	N	%	N	%			
Yes	20	37.7	33	62.3	53	100			
No	0	0	47	100	47	100	22.17	1	<0.001
Total	20	20	80	80	100	100			

TABLE 2 : among 100 total subjects, mechanical ventilators were used in 53 subjects out of which 20 expired (37.7%) and 33 survived (62.3%) with a p value of <0.001 which is statistically significant.

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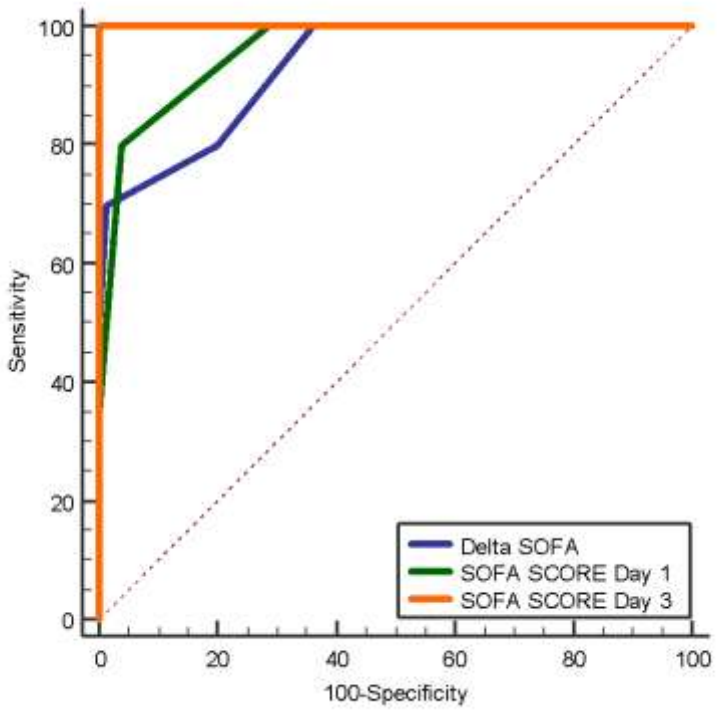

FIGURE 6 : ROC curves of delta SOFA, SOFA score on day 1 of admission and SOFA score on day 3 of admission in PICU to predict mortality in study subjects.

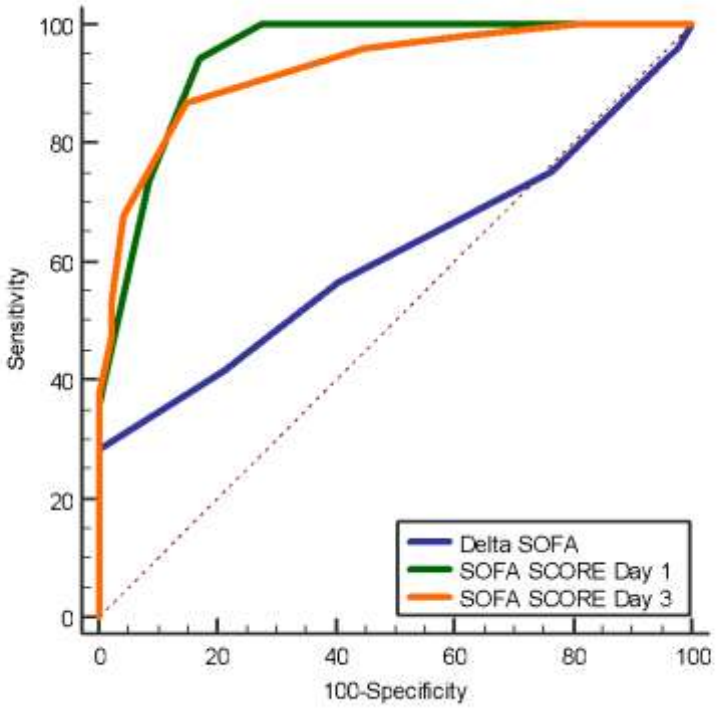

FIGURE 7 : ROC curves of delta SOFA, SOFA score on day1 and SOFA score on day3 of admission in PICU to predict the use of mechanical ventilation in study population.

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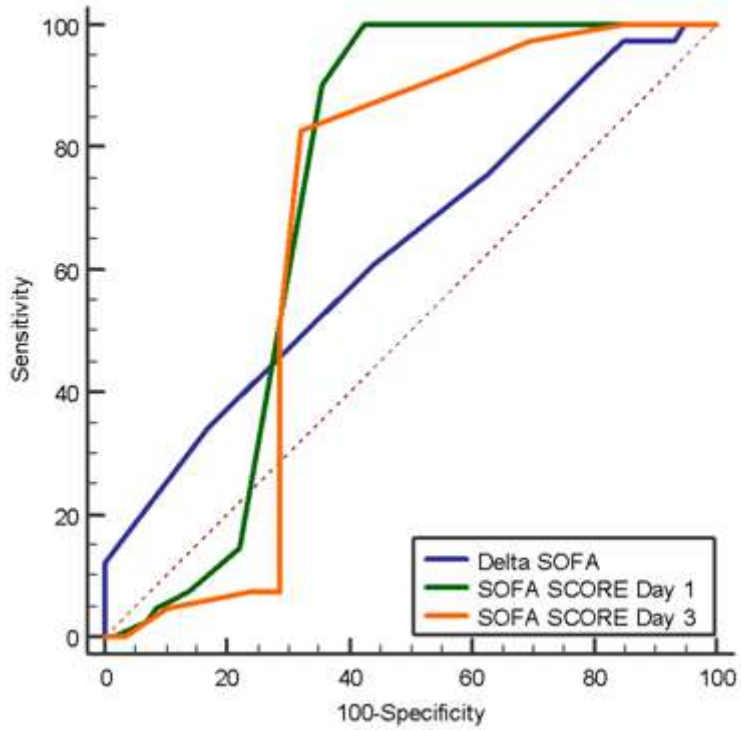

FIGURE 8 : ROC curves of delta SOFA, SOFA score on day 1 of admission and SOFA score on day3 of admission in PICU to predict the length of ICU stay > 5 days in the study subjects.

Delta SOFA	Death		Survive		Total		χ^2	df	P
	N	%	N	%	N	%			
≥2	14	93.3	1	6.7	15	100	59.314	1	<0.001
<2	6	7.1	79	92.9	85	100			
Total	20	20	80	80	100	100			

TABLE 3 : Delta SOFA Score of ≥ 2 among study subjects is associated with increased risk of mortality with a p value of <0.001 which is statistically significant.

SOFA score	Death		Survive		Total		χ^2	df	P
	N	%	N	%	N	%			
≥8	20	34.5	38	65.5	58	100	18.103	1	<0.001
<8	0	0	42	100	42	100			

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Total	20	20	80	80	100	100			

TABLE 4 : SOFA Score≥ 8 on day 1 of admission in PICU among the study subjects is associated with increased risk of mortality with a p value of <0.001 which is statistically significant.

SOFA SCORE ON DAY 1	Length of ICU Stay				Total		χ2	df	P
	≥5 days		<5 days						
	N	%	N	%	N	%			
≥8	37	63.8	21	36.2	58	100	29.659	1	<0.001
<8	4	9.5	38	90.5	42	100			
Total	41	41	59	59	100	100			

TABLE 5: SOFA Score ≥ 8 on day 1 of admission among the study subjects is associated with increased duration of PICU stay with a p value of <0.001 which is statistically significant.

Delta SOFA	Mechanical ventilation				Total		χ2	df	P
	Yes		No						
	N	%	N	%	N	%			
≥2	15	100	0	0	15	100	15.649	1	<0.001
<2	38	44.7	47	55.3	85	100			
Total	53	53	47	47	100	100			

TABLE 6 : Delta SOFA score of ≥ 2 among study population is associated with increased need of mechanical ventilation with a p value of <0.001 which is statistically significant.

SOFA score	Mechanical ventilation				Total		χ2	df	P
	Yes		No						
	N	%	N	%	N	%			
≥8	50	86.2	8	13.8	58	100	61.131	1	<0.001
<8	3	7.1	39	92.9	42	100			
Total	53	53	47	47	100	100			

TABLE 7 : SOFA score ≥ 8 on day 1 of admission among study subjects is associated with increased need of mechanical ventilation with a p value of <0.001 which is statistically significant.

IV. DISCUSSION

Out of 100 study subjects , 57 % were below one year of age with male predominance of 60 %. Similar outcome was observed in a study conducted by Z Wu et al (5) (2019) with 57.8 % of children below 1 year of age and 62.6 % male children

Overall, we observed a mortality rate of 20 %, which is comparable to other studies e.g Singh D et al6 (2019), Taori R N et al 7(2020)

We observed a proportionate increase in percentage of mortality in critically ill children with sepsis as the pSOFA score increased from day 1 to 3. In our study, the pSOFA cutoff to predict mortality was estimated to be greater than 8 points based on optimal sensitivity and specificity identical to the studies performed by Ferreira et al8 in a prospective observational study in critically ill patients (adults), and a retrospective study done by Travis et al 9 in critically ill children in 2017.

Our results regarding change in SOFA score (ΔSOFA) are consistent with a study by Jones et al 10, as they also found a positive correlation with in-hospital mortality rate ($p < 0.05$).

In our study, it was seen that when pSOFA score was more than 8 on day 1 of admission, it was associated with the use of mechanical ventilation in those subjects comparable to studies conducted by Matics et al11(2017) and Lalitha et al12(2020).

In our study, we found that the SOFA score was significantly higher in the prolonged stay group compared to short stay group. Similar finding was also observed in a study conducted by Mashed GM et al13 in 2020.

V. CONCLUSION

We adapted and validated the pSOFA score, an age adjusted paediatric version of the adult SOFA score and used it to assess the sepsis -3 definition in critically ill children. The pSOFA score showed excellent discrimination for in-hospital mortality in a general PICU population and in subgroup of patients with suspected or confirmed infection. Our assessment of the Sepsis-3 definitions in children showed promising results, but further validation in children in different settings and population is warranted.

VI. LIMITATIONS

In our study, a subset of critically ill patients with sepsis were selected; hence generalisation of findings cannot be made to children without sepsis.

Our study is a single centre study, therefore there is a need for further study to evaluate the general applicability of the pSOFA score through the use of multicentric PICU trials to facilitate greater confidence in our findings through utilization of greater number of patients and serial measurement of variables at regular intervals.

REFERENCES:

[1]. Mathias B, Mira J, Larson SD. Paediatric sepsis. Current opinion in paediatrics. 2016 Jun;28(3):380.

[2]. Weiss SL, Balamuth F, Hensley J, Fitzgerald JC, Bush J, Nadkarni VM, Thomas NJ, Hall M, Muszynski J. The epidemiology of hospital death following pediatric severe sepsis: when, why, and how children with sepsis die. Paediatric critical care medicine: a journal of the Society of Critical Care Medicine and the World Federation of Paediatric Intensive and Critical Care Societies. 2017 Sep;18(9):823.

[3]. Zaher SR, Elgohary DA, Antonios MA. Comparison between early and late mortalities due to severe sepsis in a paediatric intensive care unit: five-years-experience. Egyptian Paediatric Association Gazette. 2022 Dec;70(1):1-8.

[4]. Randolph AG, McCulloh RJ. Paediatric sepsis: important considerations for diagnosing and managing severe infections in infants, children, and adolescents. Virulence. 2014 Jan 1;5(1):179-89.

[5]. Wu Z, Liang Y, Li Z, Liu G, Zheng J, Zuo Y, Li L, Cao X, Zhang J, Liang H. Accuracy comparison between age-adapted SOFA and SIRS in predicting in-hospital mortality of infected children at China's PICU. Shock. 2019 Sep 1;52(3):347-52.

[6]. Singh D.(PDF) Mortality rates in pediatric septic shockAccessed October 23, 2019 at:https://www.researchgate.net/publication/312632469_Mortality_rates_in_pediatric_septic_shock

[7]. Taori RN, Lahiri KR, Tullu MS. Performance of PRISM (Pediatric Risk of Mortality) score and PIM (Pediatric Index of Mortality) score in a tertiary care pediatric ICU. The Indian Journal of Pediatrics. 2010 Mar;77(3):267-71.

[8]. Ferreira FL, Bota DP, Bross A, Mélot C, Vincent JL. Serial evaluation of the SOFA score to predict outcome in critically ill

patients. Jama. 2001 Oct 10;286(14):1754-8.

[9]. 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 pediatrics. 2017 Oct 1;171(10):e172352-.

[10]. Jones AE, Trzeciak S, Kline JA. The Sequential Organ Failure Assessment score for predicting outcome in patients with severe sepsis and evidence of hypoperfusion at the time of emergency department presentation. Critical care medicine. 2009 May;37(5):1649.

[11]. Matics T, Sanchez-Pinto NA. validation of a pediatric Sequential Organ Failure Assessment Score and evaluation of Sepsis-3 definition in critically ill children. JAMAPediatr. doi: 10.1001/jamapediatrics. 2017.

[12]. Lalitha AV, Satish JK, Reddy M, Ghosh S, George J, Pujari C. Sequential organ failure assessment score as a predictor of outcome in sepsis in pediatric intensive care unit. Journal of Pediatric Intensive Care. 2021 Jun;10(02):110-7.

[13]. El-Mashad GM, El-Mekkawy MS, Zayan MH. Paediatric sequential organ failure assessment (pSOFA) score: a new mortality prediction score in the paediatric intensive care unit. Anales de Pediatría (English Edition). 2020 May 1;92(5):277-85.