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Pediatric Logistic Organ Dysfunction 2 Scoring System in Predicting the Prognosis of Death in Pediatric Patients with Clinical Sepsis

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ABSTRACT

Introduction. Sepsis is still one of the main causes of mortality and morbidity in children in industrialized and developing countries. Pediatric Logistic Organ Dysfunction 2 (PELOD 2) score aims to assess the degree of organ system disorder. In addition, PELOD score 2 also has a close relationship with death and can detect any organ dysfunction even in patients with low mortality. This study aims to determine the relationship between PELOD 2 score with the death of patients in pediatric surgical cases with clinical sepsis at Dr. Mohammad Hoesin Hospital (RSMH) Palembang.

Methods. An observational analytic study with a cohort design was conducted at the Mohammad Hoesin Hospital in Palembang from August 2017 to December 2017. There were 30 samples of pediatric patients with clinical sepsis who met the inclusion criteria. Data frequency and distribution are explained in tabular form. The relationship between PELOD 2 score (Pediatric Logistic Organ Dysfunction 2) with death was analyzed by the Fisher Exact test. Survival rates are obtained by analyzing survival using Kaplan meier. Data analysis uses SPSS version 18.0.

Results. In this study, the results showed that there were no differences in age, weight, height and sex between groups with mortality and life outcomes ($p > 0.05$). With the Fisher Exact test, it was found that there was a significant relationship between PELOD 2 score and mortality in pediatric

patients with clinical sepsis (RR = 13; RR> 2; p = 0.000; p> 0.05). Of 30 pediatric patients with clinical sepsis, there were 13 deaths (43.3%) of pediatric patients with clinical sepsis where 13 out of 15 people (86.7%) in the risk group and the comparison group did not get any deaths.

Conclusions. It can be concluded that there is a significant relationship between PELOD 2 score (Pediatric Logistic Organ Dysfunction 2) with the death of patients in pediatric surgical cases with clinical sepsis at Dr. Mohammad Hoesin Hospital (RSMH) Palembang.

Keywords: pediatric logistic organ dysfunction 2, prognosis of death, sepsis, pediatric

Introduction

Sepsis is still one of the main causes of mortality and morbidity in children in industrialized and developing countries. Data in the United States shows the incidence of sepsis in patients treated in pediatric intensive care units (PICU) reaching more than 42.000 cases with a mortality rate of 10.3%. Statistical data from the Center of Disease Control shows that aged 1 year and above, the incidence of sepsis increased by 13.9%. For ages one to four years old, sepsis occupies the ninth position as the cause of death with an estimated annual mortality rate of 0.5 / 100,000 population. The peak incidence of sepsis shows a double distribution, namely the first peak in the neonatal period and the second peak at the age of 2 years. The incidence of sepsis in treatment in the Pediatric Intensive Care Unit (PICU) is 24%. Of the patients with sepsis, approximately 49% of sufferers experienced bacteremia consisting of 58% with gram (+) bacteria, and 42% with gram (-) bacteria.[1]

Thukral research in India found that 91% of children treated at PICU had multiple organ dysfunction syndrome (MODS). Mortality occurs as much as 15.7% in conditions with two organs experiencing dysfunction, and an increase of 6.3% in addition to one organ dysfunction, even reaching 100% in the condition of 6 organs experiencing dysfunction. The incidence of MODS is reported to be up to 18-25%. Other studies report the incidence to be 11-27% and deaths associated with it between 26% and 50% .[2] Data from PICU Mohammad Hoesin Hospital (RSMH) Palembang shows a mortality rate of 44% (63 out of 143) in 2006 and increased to 51 % (115 of

223) in 2007. Then the mortality rate in RSMH in 2010 became 45.7%, where the MODS incidence in the study was 75.3%. Furthermore, the prevalence of death in RSMH increased to 61.4% in the 2015 Oktahara study due to the subjects in this study all experiencing MODS to obtain a higher prevalence of death.[3]

Homeostatic disorders are assessed by measuring the number of physiological variables whose values are outside the normal value. The magnitude of this disorder affects the length of stay and prognosis of children. In assessing the mortality risk of patients being treated, an assessment system has been developed. With an assessment system it is possible to conduct a comparative audit, evaluation and monitoring of health services, as well as intensive care evaluative research. Assessment is an important element in determining prognosis and referral services for patients because it provides an objective assessment and includes a number of clinical data that will provide a conclusion that affects the duration, quality, and cost of care. This assessment system assesses several physiological disorders and co-morbidity to maximize prediction of patient mortality risk. Physiological disorders of the organ are noted at the time of initial entry. Output scores are expected to explain the severity of the disease during treatment. [4,5]

Nowadays, many instruments are found in predicting child mortality. Worldwide, the scoring system most commonly used is the pediatric index of mortality (PIM) score, pediatric logistic organ dysfunction (PELOD), and pediatric risk of mortality (PRISM), with the same version the latest is PIM 3, PELOD 2, and PRISM III. Scores are obtained from variables that are relevant to risk and death scoring and then calculated by multivariate logistic regression statistical analysis. The developed scoring system can now be divided into more specific scoring, namely organ dysfunction scores, mortality prediction scores, and other scores.[4-9] PELOD scores were introduced since 2003 and have been validated several times. Validity is said to be good if discrimination and calibration give good results. Discrimination refers to how well the score diagnoses or predicts the final result, while calibration refers to accuracy of the risk of prediction. With good calibration, if the magnitude of the score indicates a risk of death of 20% in 100 people, we should be able to predict 20 of these 100 people will die.[10,11] The PELOD score has also been used to describe the severity of the patient's disease. In 2013, Leteurtre et al re-developed and validated the PELOD score into a PELOD score of 2, which allows the assessment of the severity

of organ dysfunction on a continuous scale. The PELOD 2 score includes measurements of MAP (Mean Arterial Pressure) and blood lactate levels in cardiovascular dysfunction and does not include liver dysfunction again. In that study, it was found that discrimination was very good and calibration was better than PELOD score.[3,10,11] Research by Oktahara in 2015 got AUC score on PELOD 2 score of 81.8% (95% CI 71.8% - 91.9%) which means it is able to measure the accuracy of death well. In addition, a cut point of 6.5 with a sensitivity of 79.1% and a specificity of 74.1% was obtained.[3] The system of assessing the severity of the disease was largely studied for regulation in developed countries. Data from developing countries has conflicting results [12,13].

In this study, the researcher will analyze the relationship between PELOD 2 score and patient death in pediatric surgery cases with clinical sepsis at RSMH Palembang. By knowing the relationship between PELOD score of 2 patients in pediatric surgery cases with clinical sepsis, it is hoped that we can determine the patient's prognosis going forward so that it can contribute to a decrease in mortality.

Methods

This study is a cohort study to determine the relationship of PELOD 2 score with mortality in pediatric surgical patients with clinical sepsis at RSMH Palembang. The study subjects were all children aged more than 1 month to less than 18 years with clinical sepsis and were treated at the Mohammad Hoesin Hospital in Palembang and met the inclusion criteria. Inclusion criteria Risk groups are all children aged more than 1 month to 17 years 11 months 29 days with clinical diagnosis of sepsis and treated at Palembang RSMH children with PELOD score ≥ 11, all children who have physical examination results and laboratory tests that support the assessment of the scoring system PELOD 2 in the first 24 hours of treatment at Palembang RSMH, received approval from parents to be included in the study by signing the consent form. Inclusion criteria of the comparison group was all children aged more than 1 month to 17 years 11 months 29 days with clinical diagnosis of sepsis and hospitalized in Palembang RSMH children with PELOD score <11, all children who have physical examination results and laboratory examinations that support the PELOD 2 scoring system assessment in the first 24 hours of treatment at RSMH Palembang, are

willing to participate in the research by signing the consent form by the patient or guardian concerned . Exclusion criteria were patients who died <1 hour of treatment at Palembang RSMH and patients who died due to uncontrolled things such as anaphylactic shock and technical problems so that the tools available at Palembang RSMH could not work properly and properly.

PELOD score 2 is a score used to assess the severity of the disease and predictions of death based on abnormalities obtained at physical and laboratory examinations. PELOD scores are calculated within 24 hours of treatment by taking the most abnormal values. PELOD 2 assessment includes the calculation of Glasgow Coma Score, pupillary response to light, lactate levels in blood, measurement of mean arterial pressure (MAP), creatinine levels in blood, PaO_2 (mmHg) / FiO_2 ratio, $PaCO_2$ levels, requiring invasive ventilation or not, blood levels of creatinine blood leukocytes, blood platelet levels.

Univariate testing was performed to obtain the frequency distribution of each variable studied. A bivariate test was performed to assess the relationship between the independent variable and the dependent variable. Categorical data were tested using the chi-square test. If not testing the requirements of the chi-square test, a Fischer Exact test and the Survival Analysis using Kaplan meier were performed.

Results

The mean age of pediatric patients with clinical sepsis with a death outcome of 46.46 ± 48.036 months while with a life outcome of 43.71 ± 52.566 months. With Mann Whitney statistical analysis the probability result is 0.983 which means there is no age difference between the two outcomes.

In this study, patients with death outcomes had a height of 94.92 ± 30.674 cm and a body weight of 16.43 ± 12.53 kg while those with living outcomes had a height of 100.59 ± 30.99 cm and a body weight of 18.59 ± 11.55 kg. With Mann Whitney statistical analysis the probability results are 0.530 and 0.489, which means there is no difference in height and weight between the two outcomes.

With statistical analysis found significant differences in nutritional status between groups with outcomes of death and life (p = 0.026) where there were no patients with poor nutrition in the living outcomes group while in the death outcomes group there were 4 patients (30.8%) with undernourished nutrition. In addition, the average PELOD score of 2 pediatric patients with clinical sepsis was obtained with a mortality rate of 10.23 ± 4.53 while a survival outcome of 2.588 ± 1.417. With Mann Whitney statistical analysis the probability result is 0,000 which means that there is a difference in the PELOD 2 score between the two outcomes where the PELOD 2 score with the outcome of death is greater than patients with outside survival.

Table 1. General Characteristics of Research Subjects Based on Output

Characteristic	**Outcome**		**p *value***
	Died	**Alive**	
Age (month), mean ± SD	46,46 ± 48,036	43,71 ± 52,566	0,983[a]
Body weight (kg), mean ± SD	16,43 ± 12,53	18,59 ± 11,55	0,530 [a]
Height (cm), Mean ± SD	94,92 ± 30,647	100,59 ± 30,99	0,489 [a]
Nutritional Status, n(%)			
Good	9 (69,2)	17 (100)	0,026 [b]
Poor	4 (30,8)	0 (0)	
Sex, n(%)			
Male	11 (84,6)	9 (52,9)	0,119 [b]
Female	2 (15,4)	8 (47,1)	
PELOD 2 Score, Mean ± SD	10,23 ± 4,53	2,588 ± 1,417	0,000 [a]
Total	13	17	

a = *Mann Whitney* test, p = 0,05; b = *Fisher Exact* test, p = 0,05

From 30 pediatric patients with clinical sepsis divided into two groups, namely the risk group (PELOD score 2 ≥ 11) as many as 15 people and the comparison group (PELOD score 2 <11) as many as 15 people. With Fisher Exact test, it was found that there was a significant relationship between PELOD 2 score and mortality in pediatric patients with clinical sepsis where patients with PELOD score ≥ 11 had a significantly higher risk of death compared to patients with PELOD score 2 <11. (p = 0,000; p> 0.05).

Table 2. Relationship of PELOD 2 Score with Child Mortality with Clinical Sepsis

Characteristic	Death		Total	*p value**
	Yes	No		
Group				**0,000**
• Risk	13	2	15	
• Comparison	0	15	15	
Total	13	17	30	

* *Fischer exact test,* p = 0,05

Of 30 pediatric patients with clinical sepsis, 17 survivors (survivors) were found (56.7%) where in the risk group there were 2 survivors (13.3%) and the comparison group 15 persons (100%) while the incidence of death of pediatric patients with clinical sepsis was 13 (43.3%) out of a total of 30 people where there were 13 people in the risk group (86.7%) and no children were found in the comparison group.

Discussion

Sepsis is a life-threatening organ dysfunction caused by immune dysregulation against infection. The prevalence of death in RSMH of 61.4% in the Oktahara study in 2015 is far different from this study in which there were patients with a mortality outcome of 43.3% .[14-16]

In this study, the results showed that there were no differences in age, weight, height and gender of pediatric patients with clinical sepsis whether or not they had died. This means that the outcome of death in pediatric patients with clinical sepsis in this study was not influenced by age, weight, height and gender. However, there were significant differences in nutritional status between the two groups where patients with poor or poor nutrition were more at risk of dying than patients with good nutrition. Obtained from 4 patients with poor nutrition or less 100% of patients finally died. This is different from the 2015 Oktahara study where the results of the bivariate analysis found no significant differences in the nutritional status and in the Octahara study PELOD 2 ranged from 2-25 with the average PELOD 2 score of 11.5 (SD 7.33)

PELOD score 2 aims to assess the degree of organ system disorder. In addition, PELOD score 2 also has a close relationship with death and can detect any organ dysfunction even in patients with low mortality. In this study PELOD score of 2 pediatric patients with clinical sepsis was 5.9 ± 4.943 with a range from 0 to 16. The average PELOD 2 score with a mortality outcome was 10.23 ± 4.53 while with a life outcome of 2.588 ± 1.417, there were differences PELOD scores between the two outcomes where the PELOD score 2 with death outcomes is greater than patients with live outcomes (p = 0,000). The results of this study are also not different from the 2015 Octahara study where the average PELOD 2 score in the dead was 14.64 (SD 7.32) while in the living 6.48 (SD 3.68).

The PELOD 2 score includes ten variables involving five organ dysfunctions. The variables used to make and validate PELOD 2 were taken from the PELOD score (Glasgow Coma Score, pupillary reaction, heart frequency, systolic blood pressure, creatinine, PaO2 / FiO2, PaCO2, use of mechanical ventilation, count of leukocytes, platelet count, aspartate transaminase , prothrombin time and normal international ratio) and PMODS scores (lactate, PaO2 / FiO2, bilirubin, fibrinogen, and blood urea nitrogen). Furthermore, MAP which is a variable of SOFA scores in adults is also added because it is considered a good marker of organ perfusion.[17] Total scores indicate the percentage of possible deaths. As the number of organ dysfunction increases, the PELOD score will increase.[18-22]

The examination of the neurological system is carried out through the Glasgow Coma Scale (GCS) to determine the degree of consciousness and pupillary reflex examination using the ABN penlight. In this study the results show that there are differences in GCS between patients with

death outcomes and life outcomes where the GCS of pediatric patients with death outcomes is smaller than life outcomes. However, there were no differences in pupillary reflexes between the two groups in which all patients (100%) both the living or dead group showed reactive pupillary reflexes.

The cardiovascular system (lactate and MAP levels) and the respiratory system (PaO2, PaCO2, and the use of mechanical ventilation) were used to determine the PELOD score 2. In this study the results showed no difference in the respiratory system (PaO2 and PaCO2) between the two groups, but there were differences in the use of mechanical ventilation where 92.3% of patients with death outcomes used mechanical ventilation and none of the patients with living outcomes used mechanical ventilation. As for the cardiovascular system, the results show that there are differences in lactate levels between the two groups where patients with death outcomes have higher lactate levels than patients with live outcomes. However, there was no difference in MAP between the two groups.

In addition to the neurological, respiratory and cardiovascular systems, a kidney system examination is also performed to determine the PELOD 2 score, namely the creatinine level examination. In this study the results showed that there were no differences in creatinine levels between patients with death outcomes and life outcomes.

Examination for the hematological system, namely examination of the number of leukocytes and platelets is also needed to determine the PELOD score 2. In this study the results showed no differences in leukocytes between the two groups, but there are differences in platelets in which the platelet count in patients with a death outcome is lower than the platelet count of patients with patients living output.

It can be concluded in research between the two groups of almost all systems there are differences except for the kidney system where differences in the neurological system (Glasgow Comma Scale), cardiovascular system (lactate levels), respiratory system (mechanical ventilation), hematological system (number of platelets) between the two groups. From the average results of the examination of the five organ systems, the results showed that patients with death outcomes showed worse organ system disorders compared to patients with live outcomes where lower GCS was obtained, higher lactate levels, lower platelet counts and higher use of ventilation in groups with statistically significant outcomes of death. In addition, there was a lower MAP, higher

creatinine, lower PaO2, higher PaCO2 and higher leukocytes in the group with a death outcome but were not statistically significant. In the 2015 Oktahara study, the results of bivariate analysis showed 4 organ systems that statistically significantly affected mortality, namely neurological, cardiovascular, renal and hematological. This is different from the 2013 Leteurtre study in which 5 organ systems were found to be statistically significant in influencing death, with neurological organ dysfunction and respiration the most influential.

Pediatric patients with clinical sepsis who had assessed PELOD 2 scores were then followed for 28 days. In this study, there are two groups divided based on the cut point value of PELOD 2 score, namely 11. Based on the cut point, the group in this study was divided into two, namely the first risk group with a score of PELOD 2 ≥ 11, 15 respondents and the second comparison group with PELOD score values 2 <11 as many as 15 respondents. After 28 days, 13 out of 15 patients in the risk group died while in the comparison group there were no deaths. With Fisher Exact statistical analysis it was concluded that the risk group ie patients with PELOD score 2 ≥ 11 were significantly more at risk of death than the comparison group ie patients with PELOD score <11. So it can be concluded that there was a significant relationship between PELOD score 2 (Pediatric Logistic Organ Dysfunction 2) with the death of the patient in pediatric surgical cases with clinical sepsis at Dr. Hospital Mohammad Hoesin (RSMH) Palembang

With survival analysis, there was a significant difference in survival between risk groups and comparison groups, but because there were no deceased patients in the comparison group, it could not be statistically analyzed so there was no mean survival of patients in either group.

Conclusion

There is a significant relationship between PELOD 2 score (Pediatric Logistic Organ Dysfunction 2) with the death of patients in pediatric surgical cases with clinical sepsis.

References

1. Watson RS, Carcillo JA, Linde-Zwirble WT, Clermont G, Lidicker J, Angus DC. The epidemiology of severe sepsis in children in the United States. Am J Respir Crit Care Med. 2003;1;167(5):695- 701.

2. Thukral A, Kohli U, dkk. *Validation of the PELOD Score for Multiple Organ Dysfunction in Children*. Indian Pediatrics. 2007; 44:683-86.
3. Oktahara Y, Triratna S, dkk. 2015. Penggunaan Skor Pediatric Logistic Organ Dysfunction 2 sebagai Prediktor Mortalitas Anak yang Dirawat di Unit Perawatan Intensif Anak RSMH Palembang. Palembang: Departemen Ilmu Kesehatan Anak Fakultas Kedokteran Universitas Sriwijaya.
4. Lacroix J, Cotting J. *For the Pediatric Acute Lung Injury and Sepsis Investigators (PALISI) Network. Severity of Illness and Organ Dysfunction Scoring in Children.* Pediatr Crit Care Med. 2005; 6:S126-34.
5. Yeh TS, Pollack MM, Ruttiman UE, Holbrook PR, Fields AI. *Validation of A Physiologic Stability Index for Use in Critically Ill in Infants and Children*. Pediatric Res. 1984; 18:445-51.
6. Leteurtre S, Martinot A, Duhamel A, Gauvin F, Grandbastien B, Nam TV, dkk. *Development of A Pediatric Multiple Organ Dysfunction Score. Use of Two Strategies*. Medical Decision Making. 1999; 19:399-410.
7. Marcin JP, Pollack MM. *Review of The Acuity Scoring Systems for The Pediatric Intensive Care Unit and Their Use in Quality Improvement*. J Intensive Care Med. 2007; 22:131-40.
8. Marcin JP, Pollack M, Ruttiman UE, dkk. *Triage Scoring Systems, Severity of Illness Measures and Mortality Prediction Models in Pediatric Trauma.* Crit Care Med. 2002; 30:S457-67.
9. Castellanos-Ortega A, Delgado-Rodriguez M, Llorca J, Sanchez-Buron P, Mencia-Bartolome S, Soult-Rubio A. A new prognostic scoring system for meningiococcal septic shock in children. Comparison with three other scoring systems. Intensive Care Med 2002;28:341-51.
10. Leteurtre S, Martinot A, Duhamel A, Proulx F, Grandbastien B, Cotting J, Gottesman R. *Validation of The Paediatric Logistic Organ Dysfunction (PELOD) Score: Prospective, Observational, Multicentre Study*. Lancet. 2003; 362:192-7.
11. Leteurtre S, Duhamel A, dkk. PELOD 2: *An Update of The Pediatric Logistic Organ Dysfunction Score*. Critical Care Med. 2013; 41(7):1761-73.

12. Knaus WA, Draper EA, Wagner DP, dkk. *Prognosis in Acute Organ System Failure*. Ann. Surg. 1985; 202;6:685-93.
13. Friedrich JO, Wilson G, Chant C. *Long-Term Outcomes and Clinical Predictors of Hospital Mortality in Very Long Stay Intensive Care Unit Patients: A Cohort Study*. Crit Care. 2006; 10(2):R59.
14. Schexnayder SM. Pediatric Septic Shock. Pediatrics in Review 1999; 20 (9): 303-8
15. IDAI. Kosensus Diagnosis dan Tatalaksana Sepsis pada Anak. Jakarta: BP IDAI 2016.h 1-5
16. Paterson, R. L., and Webster N. R., Sepsis and Inflamatory Respon Syndrome dalam Journal of The Royal College of Surgeoons of Edinburgh 2008;p. 178-82
17. Plunkett A, Tong J. Sepsis in children. BMJ 2015;350:h3017.
18. Frevert CW. The inflammatory response of gram negative pneumonia and its relation to clinical disease. (24/2/2016). Melalui http://www.sciencemedicine. com.
19. Hattaway WE, Bonnar J. 1987. Physiology of coagulation in the fetus and newborn infant.Hemostatic disorder of the pregnant woman and newborn infant, 1st edition, Elsevier, NewYork :57-68.
20. Choi G, Schultz MJ, Leve M, Poll T. 2006. The relationship between inflammation and the coagulation system. Swiss Med Wkly 136:139–44.
21. Mammen EF. 1998. The haematological manifestations of sepsis. JAC41 Suppl:A17– 24
22. Sareharto, TP. Sirkulasi Mikro Pada Sepsis. SUB Bagian Pediatri GAwat Darurat Bagian Ilmu Kesehatan Anak FK UNDIP RSUP Dr. Kariadi Semarang. 2007; p. 1-12