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Use of pediatric logistic organ dysfunction (PELOD) in determining prognostic among pediatric intensive care unit patients

Lulu Honna¹, Silvia Triratna¹, Triwani², Theodorus³

Abstract

Background Pediatric intensive care unit is the place for caring the children with higher risk of mortality, usually with multiple organ dysfunction syndrome (MODS) that can increase difficulty in determining prognostic. Therefore, an objective severity-of-illness and organ-dysfunction score is needed. Pediatric logistic organ dysfunction (PELOD) score can be considered as a representative for probability of death and predicting the prognostic.

Objective To determine the prognostic of patients in PICU Mohammad Hoesin hospital (RSMH), Palembang, using PELOD score.

Methods An observational study was conducted from April-September 2009 among PICU patients. PELOD score was assessed in the first 24 hour. Statistical analysis was performed using Z-Mann Whitney test, Hosmer-Lemeshow goodness-of-fit, ROC curve and survival analysis Kaplan Meier (KM).

Results There were 45 (55%) boys and 36 (44%) girls with mean age 51 (SD 6,47) months. Children with MODS were 75%. Death was 37 (45%) and survival was 44 (54%) with mean length of stay was 181,92 (SE 30,23) hours. PELOD score was from 0 to 51. The best PELOD score related to death in coordinate point was 20,5 with ROC 0,862. Length of stay in grup with PELOD score < 20,5 was 371,22 (SE 82,13) hours and > 20,5 was 93 (SE 17,48) hours (log rank p=0,000). Survival function KM showed that the higher PELOD score, the shorter length of stay in PICU. Henceforth, the higher probability prediction of mortality.

Conclusion PELOD score can be used as a prognostic predictor of mortality among PICU patients in Mohammad Hoesin Hospital (RSMH), Palembang. [Paediatr Indones. 2010;50:347-50].

Keywords: PELOD score, prognostic, prediction, death, PICU

Patients in pediatric intensive care unit (PICU) are children in higher risk of mortality. They usually experience multiple organ dysfunction syndrome (MODS). Tantalean¹ (2003) in Peru found that 56% children in PICU had already in MODS condition. Meanwhile, Thukral² in India discovered 91% children were in the same condition. According to Tan³ (1998), children with MODS had higher mortality risk up to 11.3 times than those without MODS. It is predicted that mortality rate related to MODS in PICU ranged from 35% to 50%.^{4,5}

Severity of illness and objective mortality prediction of each patient in PICU are necessary to be assessed, among other things, in order to have the family well-understood about condition of the patient. Therefore, the lawsuit of malpractice addressed to the doctors can be avoided.^{6,7} The rational and objective way to determine and assess severity of illness could be done using probability model to predict mortality risk.⁸⁻⁹

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Severity of illness and objective mortality prediction of each patient in PICU are necessary to be assessed, among other things, in order to have the family well-understood about condition of the patient. Therefore, the lawsuit of malpractice addressed to the doctors can be avoided.^{6,7} The rational and objective way to determine and assess severity of illness could be done using probability model to predict mortality risk.⁸⁻⁹

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PELOD score is a score used to determine the presence of organ dysfunction and severity of either each organ system or among several organ systems (multiple organ dysfunction syndrome).¹⁰⁻¹¹ PELOD score can be considered as a prediction for prognosis and probability of death. There is still lack of data using organ dysfunction score in PICU patient in predicting the mortality. The aim of this study is to find out the prognosis of patients in PICU using PELOD score.

Methods

This study was conducted in PICU-RSMH from April to September 2009. The inclusion criteria were critical patients in PICU and written informed consent from each child's parents or legal guardian prior to enrollment. Exclusion criterion was patients, with any reason, who did not undergo full laboratory examination which was needed in PELOD score.

PELOD score were calculated from physical and laboratory examination compatible with PELOD score table by taking the most abnormal findings in the first 24 hours of admission. MODS was defined as a presence of failure or dysfunctions of two or more organ systems. Length of stay was defined as the period of time a patient remains in a hospital or other health care facility as an inpatient.

PELOD score was analysed in survival and nonsurvival (death) patients using Z-Mann Whitney. Death prediction according to PELOD score was analysed using logistic regression technique with PELOD score as independent variable dan death as dependent variable. Hosmer- Lemeshow test (goodness-of-fit) was used to determine the calibration for PELOD score and ROC curve was used regarding the discrimination for PELOD. To determine the incident of death and its relation to length of stay, analysis survival with Kaplan-Meier (KM) methods was used. Log rank statistic was used to see relation of PELOD score between both groups. All data were processed using SPSS 15 version software.

Results

Ninety seven subjects were enrolled this study. Sixteen were dropped-out because they did not undergo

complete laboratory examination. Boys and girls ratio were 1.25:1. Mean age was 51 (1 to 268) month-old. During study period, 37/81 was dead while the others had good improvement and were moved to ward. Incidence of MODS was 75% (Table 1).

We observed there was no improvement was made when the PELOD score greater than 33. Mean PELOD score was significantly higher in 'died' group (28.2, SD 12.5) than in 'improved' group (11.5, SD 9.3; P= <0.05). (Table 2)

PELOD score calibration result was 5.067 (P=0.652) dan ROC was 0.862 (95% CI 0.782 to 0.942). The best PELOD score related to death in coordinate point with sensitivity (81.1%) and specificity (77.3%) was 20.5. Using this point, PELOD score was divided into two groups risk of mortality; high PELOD score (>20.5) and low PELOD score (≤20.5).

The overall mean of length of stay in PICU using Kaplan-Meier was 181.9 (SD 30.23) hours. With cut-off point of 20.5, high risk group had significantly shorter length of stay (93, SD 17.5) than those in low risk group (371.2, SD 82.13). (Log rank test P < 0.05) (Figure 2).

Table 3 shows follow up of subjects according to risk of mortality. 'Number at risk' mean number of subjects who were still in PICU at the time of follow up. At the end of study, 30/40 high risk subjects were died, while only 7/41 were died in low risk group.

Discussion

Death prevalence in PICU RSMH was 45.7% with varied primary illness. Only 10 (12.34%) of them was

Table 1. General characteristic of patients

Characteristic	n	Characteristic	n
Age		Outcome	
1mo-12 mo	34	Died	37
>12 mo	47	Improved	44
Gender		Primary disease	
Boy	45	Post operative	10
Girl	36	Medical	71
Nutritional status		Σ organ dysfunction	
Well nourish	37	0	6
Under nourish	37	1	14
Severe nourish	7	2	17
Mechanical ventilator		3	19
With	40	4	8
Without	41	5	15
		6	2

Table 2. Distribution of PELOD score and result after admission in PICU

PELOD Score	Outcome		PELOD Score	Outcome	
	Died	Improved		Died	Improved
0	0	6	23	2	1
1	1	6	24	1	0
2	1	2	30	2	2
10	1	6	31	5	1
11	1	7	33	3	0
12	1	3	40	1	0
13	2	0	42	8	0
20	0	4	43	1	0
21	5	2	51	1	0
22	1	4			

$$P = \frac{1}{1 + e^{-(-2,654+0,128 \cdot \text{skor PELOD})}}$$

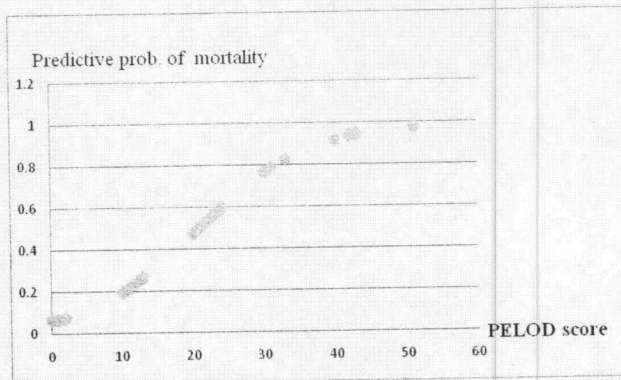


Figure 1. Predictive probability of death according to PELOD score

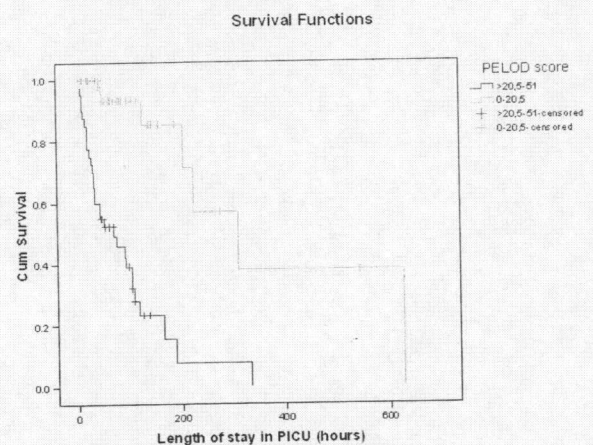


Figure 2. Distribution curve KM for length of stay according to PELOD score

Table 3. Follow up result based on PELOD score

Follow up (hours)	50		100		150		630		n
	No. at risk		27		11		0		
Result	Died	Improved	Died	Improved	Died	Improved	Died	Improved	
PELOD Score ≤ 20.5	2	14	0	9	1	7	4	4	41
PELOD Score >20.5	19	2	4	4	4	4	3	0	40

surgical cases or post-operation, while 71 (87.66%) were medical cases. This finding was different from the place where PELOD score was first time developed. The surgical case was 49% of the whole admission and death prevalence was only 6.4%.¹¹ The condition of PICU RSMH were similar to research found by Qureshi¹² in Pakistan which there were 86% of non-surgical/medical cases in the PICU with death prevalence up to 28.7%.

PELOD score was developed by Leteurtre, et al^{11,13} and had been validated in 2003 with valid end result of MODS severity in critical ill children.

PELOD score was significantly higher in those who were dead (mean 31 (SD 1.2)), than those who survive (mean 9.4 (SD 0.2)).¹¹ In the previous research by Metta¹⁴ (2006), mean PELOD score in dead patients were 22.2 (SD 10.1) and 13.5 (SD 8.5) in those who were alive. In this research, mean PELOD score in dead patients was 28.2 (SD 12.5) and mean score in alive patients were 11.5 (SD 9.3). The Calibration results by Leteurtre^{11,13} et al in 2003 showed p=0.54, then being corrected in 2006 and become p=0.000. Even so, Leteurtre said that PELOD score was a quantitative score which

primarily becoming a descriptive score which was able to show relation between the score and the severity of illness.^{15,16}

This study did not use the same equation discovered by Leteurtre et al, yet by counting group of data in one period of time. The formula of this equation is shown in **Figure 1**.^{14,16} Calibration result ($X^2=5,06$, $p=0.652$) and area under the ROC curve (0.862) of this study showed a good validity in predicting death. Its best cut of point was at 20.5 at 81.1% of sensitivity and 77.3% of specificity.

In this study, the most common dysfunction case was in neurological organ in total organ dysfunction 2,3,5, dan 6. It was experienced by 79% of subjects (data was not shown). This finding is compatible with Tantalean¹ which found that one of the most common organ dysfunction is neurological. MODS in PICU patient will increase mortality risk up to 11.3 times⁴, and in this study was 12.12.

Length of stay in PICU reflected degree of severity and health status, also the quality and performance of PICU.¹⁷ Length of stay of the subject and mortality prediction using survival analysis KM in high PELOD score group was significantly different ($p=0.000$) from low PELOD score group. From KM distribution curve (figure 2) dan table 2 showed that 51% of patients with high PELOD score and length of stay <50 hours were not survived. This mortality prediction becomes an informative prognosis that could be informed to the patients family.

We conclude that PELOD score can be used as a prognostic predictor of mortality among PICU patients in RSMH Palembang. We suggest to conduct a study using bigger size of sample so that better evaluation using PELOD score in PICU can be obtained.

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