International Journal of Contemporary Pediatrics
Gobbur S et al. Int J Contemp Pediatr. 2023 Jul;10(7):1057-1060
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20231842

Original Research Article

Utility of paediatric logistic organ dysfunction score in predicting mortality in children admitted to PICU at a tertiary care centre

Soujanya Gobbur, Ashok Badakali*, Ramesh Pol, Ramesh Neelannavar

Department of Paediatrics, S.N. Medical College and HSK Hospital, Bagalkot, Karnataka, India

Received: 23 April 2023
Revised: 16 May 2023
Accepted: 22 May 2023

***Correspondence:**
Dr. Ashok Badakali,
E-mail: ashokbadakali@gmail.com

ABSTRACT

Background: Critically ill children are typically characterized by multiple organ dysfunctions. The use of Paediatric logistic organ dysfunction-2 (PELOD-2) scoring systems has recently been replicated in the paediatric population for morbidity and mortality predictions. Objective of the study was to study the PELOD 2 score in predicting mortality in paediatric intensive care unit within 1 hour of admission.
Methods: This was prospective observational study conducted at S Nijalingappa Medical College and Hanagal Shri Kumareshwar Hospital, Bagalkot for period of 16 months. Children aged from 1 month to 14 years admitted to PICU were included in the study and patients whose parents refuse to give consent, age less than 1 month or more than 14 years, those discharged against medical advice were excluded from the study. Venous blood sample were collected within one hour of admission and were analyzed for serum creatinine, serum lactate, total leukocyte count and platelet count and arterial blood sample were collected and paO2 and paCO2 were analysed.
Results: Total sample size of study was 80, out of which 52 patients had PELOD 2 score of (<4), 14 patients had score of (5-9), 11 patients had score of (10-14) and 3 patients had score >15.Among total 80 patients 66 survived and 14 died (17.5%). Of the 14 deaths, 3 patients had PELOD 2 score of >15 and 9 had score of 10-14. Pelod-2 score >9 had requirement of mechanical ventilation in 68.4%.
Conclusions: Higher the PELOD-2 score on day 1of admission has higher the mortality.

Keywords: Critical, Organ dysfunction, Mortality, PELOD 2 score

INTRODUCTION

Recent health care facility is focused on providing high-quality care. A common adage is you can't improve what you can't measure. Scoring systems are usually an objective measure which can assess quality of care, assist with the evaluation and modification of complex systems of care, improve patient outcomes and predict morbidity and mortality.[1] Broadly, these scores can be divided into two categories. The first is prognostic scores which predict the risk of death at the time of entry into PICU, and the other category is of the descriptive or outcome scores which describe the course of illness after the admission into PICU.[2]

The maximum often used predictive rankings in PICUs are Paediatric Risk of Mortality (PRISM) and the Paediatric Index of Mortality (PIM) scores, while the descriptive score widely used to assess multiple organ dysfunction syndrome (MODS) is the Paediatric Logistic Organ Dysfunction score (PELOD) as multiple organ dysfunction syndrome is more common than death in pediatric intensive care units.[2-4] PELOD-2 is the more modern model of PELOD and has currently been proven with right discrimination and calibration. PELOD-2 score

calculated from, five organ systems (neurologic, cardiovascular, respiratory, renal, and hematologic) and 10 variables (namely GCS, Pupillary reaction, lactatemia, imply arterial blood pressures, PaO2/FiO_2 ratio,PaCo2, invasive ventilation, creatinine, white blood count, and platelets) were collected.6 PELOD 2 score is studied within one hour of admission and followed up to see outcome of patient and studied the mortality percentage in these patients to identify ideal patients to admit in our PICU.

In our study, the PELOD 2 score within 1 hour of admission is used in predicting mortality in paediatric intensive care unit.

METHODS

This is a hospital-based prospective observational study conducted over a period of 16 months from January 2021 to June 2022 at the paediatric intensive care unit of a tertiary care teaching hospital S. Nijalingappa Medical College and Hanagal Shri Kumareshwar Hospital and Research Centre in Bagalkot after obtaining institutional ethical clearance. Sample size estimation was done using Medcalc software, which was 80. After taking informed written consent, children admitted to PICU of HSK hospital of aged from 1 month to 14 years of age were included and patients whose parents refuse to give consent, patients younger than 1 month or older than 14 years and those discharged against medical advice were excluded from the study.

Each patient was evaluated for 10 parameters within 1 hour of admission, which includes Glasgow coma scale (GCS) and pupillary reaction for central nervous system, lactate levels in blood, mean arterial blood pressure (MAP) for cardiovascular system, creatinine for renal assessment, PaO_2/FiO_2 and $PaCO_2$ in arterial blood gas and invasive ventilation requirement for respiratory system assessment and total leucocyte count and platelet count for haematological system. Each parameter was given points between 0 and 6 and PELOD 2 score is calculated with a sum total of these points. The highest possible score was 33 and minimum 0.6 Statistical analysis was done using SSPS statistical package for social sciences, IBM, SSPS Statistics, 19.0

RESULTS

Out of the 80 total children, 56 were male (70%) and 24 were female (30%) with male to female ratio of 2.3:1 (Table 1).

Table 1: Demographic profile of the patients.

Parameter		No. of cases	Percent
Age in years	<1	18	22.5
	01-12	47	58.8
	>12	15	18.8
	Total	80	100
Gender	Male	56	70
	Female	24	30
	Total	80	100

Table 2: Relationship between primary disease at admission and mortality.

Primary disease at admission	No. of cases	Survived		Death	
		Count	%	Count	%
Sepsis	5	4	80	1	20
Cardiovascular	2	2	100	0	0
Respiratory	33	29	88	4	12
Neurologic	15	13	87	2	13
Hematological	2	0	0	2	100
Endocrine	8	8	100	0	0
Gastrointestinal	4	4	100	0	0
Renal	5	3	60	2	40
Other systemic causes	6	3	50	3	50
Total	80	66	82.5	14	17.5

Table 3: Relationship between PELOD 2 score at admission and mortality.

PELOD-2 score	No. of cases	Survived		Death	
		Count	%	Count	%
0-4	52	52	100	0	0
05-09	14	12	86	2	14
10-14	11	2	18	9	82
> 15	3	0	0	3	100
Total	80	66	82.5	14	17.5

Table 4: Relationship between PELOD-2 score at admission and requirement of mechanical ventilation.

Mechanical Ventilation	No. of cases	PELOD-2 SCORE							
		0-4		05-09		10-14		> 15	
		Count	%	Count	%	Count	%	Count	%
Required	19	1	5.3	5	26.3	10	52.6	3	15.8
Not required	61	51	83.6	9	14.8	1	1.6	0	0
Total	80	52	65	14	17.5	11	13.8	3	3.8

Mortality in males was 14.3% and in females 25%. Mortality was highest in >12 years age group. Respiratory system was most common system with 41.3% of total included followed by neurology and endocrine. The system wise mortality descending order was haematological (100%), renal (40%), sepsis (20%) and neurological (13%) (Table 2).

Table 5: Sensitivity and specificity of PELOD-2 score.

PELOD-2 score	Died	Survived	Total
>9	12	2	14
≤9	2	64	66
Total	14	66	80

Sensitivity of 86%, specificity of 86%, positive predictive value (PPV) of 97%, negative predictive value (NPV) of 97% and accuracy of 95%.

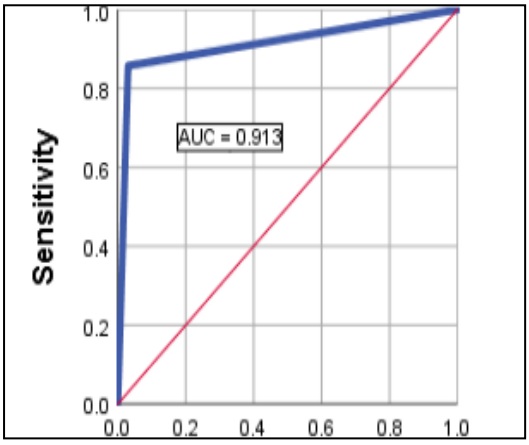

Figure 1: ROC curve of PELOD 2 score and mortality.

The score was grouped as score 0-4, score 5-9, score 10-14, score >15.Out of 80 patients admitted in the study (Table 3), 52 patients had a score of 0-4 with 0 death, 14 patients had score between 5-9 with 2 deaths and mortality rate of 14%. Mortality observed in group with score 10-14 was 82%.Maximum death observed in group with score >15 with mortality rate of 100% was statistically significant. In our study (table 4), 19 got intubated out of which 5 survived and 14 died with mortality rate of 74%. The degree of discrimination among the survivors and the non survivors were calculated using ROC. In our study area under curve of 0.913 indicated a good discrimination (Figure 1)

DISCUSSION

In our study the male to female ratio of 2.3:1 and the most common age group involved observed was 1-12 years. Thukral et al in their study for the validation of the PELOD score for multiple organ dysfunction in children observed the male to female ratio was 1.78.[5] Infants accounted for 41.2% of the study population. Leteurtre et al observed in their study that more admissions were from age group 1–11 months (29.1%). Above studies showed male preponderance similar to our study.[6]

In our study, out of total 80 patients most common system was respiratory with 33 patients (41.3%) followed by neurology (18.8%). Patients with hematological involvement had highest mortality of 100% followed by renal system with 40% which was statistically significant (p value<0.015). Nawawy et al in their study for performance of PELOD and PELODs-2 scores in a PICU in a developing country observed that 44% cases among total had respiratory system involvement.[8] Patki et al in their study noted that out of the total 120 cases, most had neurological involvement 32 patients (26.7%) with mortality being 28%.[7]

In our study, 23.7% of 80 patients were ventilated and 74% among ventilated cases died which was significant with p<0.001.Similarly in a study done by D Tejaswini et al of the total admitted patients, 23 (17.8%) patients were ventilated and 17 out of them died (73.9%). A significant association with mortality and need for ventilation was observed. Similar observation has been observed with Zhong et al in their study observed that 14% of the survivors and 78.6% of the non survivors were ventilated with a significant association with mortality (p≤0.001).[9]

The association of PELOD-2 with outcome obtained suggested maximum mortality in the group with score >15 (100%). The score of >9 had maximum sensitivity (86%) and specificity (86%) for the mortality. Mortality rate (17.5%) in our study which was higher in contrast to that observed in developed countries. Discrimination capacity is assessed using the area under the ROC curve (AUROC), where 1 is a perfect curve (100% discriminative capacity) and 0.5 is a random chance effect. In our study, PELOD-2 score had AUROC of 0.87 which means that an arbitrary patient who died had 87% chance of having a higher predicted risk than an arbitrary patient who survived.

Ramazani et al found that mean score of PRISM III, PIMS, and PELOD-2 was significant in non survivors compared with survivors (p<0.001, p<0.001, and p<0.0001, respectively) with AUC= 0.803 for PELOD-2 score.[11] They observed that in terms of discrimination power, the performance of PIM3 and PELOD-2 was slightly better than that of the PRISM III.

Zhong et al in their study found that day 1 PELOD-2 score and day 1 q PELOD-2 score were effective and able to assess the prognosis of children with sepsis in PICU.[9] The AUC obtain for above were 0.916 and 0.802, respectively. Mathews et al in their study found that PELOD-2>20 predicted mortality in 72.2% patients.

Based on the ROC curve, PELOD-2 score >16 predicted mortality with a sensitivity 100% and specificity 54.1%. The ROC for PELOD-2 obtained was 0.78.[12]

Karam et al. in his study for performance of PELOD-2 in critically ill children requiring plasma transfusions observed that the day 1 PELOD-2 AUC was 0.76 with the Hosmer–Lemeshow test was p=0.76. The serial evaluation of changes in daily PELOD-2 scores from day 1 demonstrated a significant association with death.[13]

Our study is a single center study comprising a small data set and this likely affected the internal validity of the study and collection of data of only admission PELOD-2 scores likely underestimated the incidence of MODS throughout the PICU stay.

CONCLUSION

Pediatric logistic organ dysfunction-2 on day 1 of admission score has a strong prediction value to describe organ dysfunction. Mortality rate increases with increase in PELOD-2 score, i.e., higher the PELOD-2 score higher the mortality.

This scoring advocate for better resource allocation and better patient outcomes to reduce mortality especially in patients with lower admission PELOD-2 scores and this would therefore increase the quality, efficiency and effectiveness of PICU.

ACKNOWLEDGEMENTS

Authors would like to thank the patients who volunteered for the study and the clinicians responsible for their day-to-day clinical care.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Buttram SDW, Bakerman PR, Pollack MM. Scoring systems in critical care. In: bakermanpaul, editor. pediatric critical care medicine. 2nd ed. london: Springer. 2014:47-54.
2. Gulla KM, Sachdev A. Illness severity and organ dysfunction scoring in pediatric intensive care unit. Indian J Crit Care Med. 2016;20(1):27-35.
3. Thukral A, Lodha R, Irshad M, Arora NK. Performance of Pediatric Risk of Mortality (PRISM), Pediatric Index of Mortality (PIM), and PIM2 in a pediatric intensive care unit in a developing country. Pediatr Crit Care Med. 2006;7(4):356-61.
4. Leteurtre S, Martinot A, Duhamel A, Proulx F, Grandbastien B, Cotting J, et al. Validation of the paediatric logistic organ dysfunction (PELOD) score: prospective, observational, multicentre study. Lancet. 2003;362(9379):192-7.
5. Thukral A, Kohli U, Lodha R, Kabra SK, Arora NK. Validation of the PELOD score for multiple organ dysfunction in children. Indian Pediatr. 2007;44(9):683.
6. Leteurtre S, Duhamel A, Salleron J, Grandbastien B, Lacroix J, Leclerc F. Groupe francophone de réanimation et d′Urgences pédiatriques (GFRUP). PELOD-2: an update of the pediatric logistic organ dysfunction score. Crit Care Med. 2013;41(7):1761-73
7. Patki VK, Raina S, Antin JV. Comparison of severity scoring systems in a pediatric intensive care unit in India: a single-center prospective, observational cohort study. J Pediat Intensive Care. 2017;6(02):098-102.
8. El-Nawawy A, Mohsen AA, Abdel-Malik M, Taman SO. Performance of the pediatric logistic organ dysfunction (PELOD) and (PELOD-2) scores in a pediatric intensive care unit of a developing country. Eur J Pediatr. 2017;176(7):849-55
9. Zhong M, Huang Y, Li T, Xiong L, Lin T, Li M, et al. Day-1 PELOD-2 and day-1 “quick” PELOD-2 scores in children with sepsis in the PICU. J Pediatr. 2020;96(5):660-5.
10. Deshmukh T, Varma A, Damke S, Meshram R. Predictive efficacy of pediatric logistic organ dysfunction-2 score in pediatric intensive care unit of rural hospital. Indian J Crit Care Med. 2020;24(8):701-4.
11. Ramazani J, Hosseini M. Comparison of the predictive ability of the pediatric risk of mortality III, pediatric index of mortality, and pediatric logistic organ dysfunction in medical and surgical intensive care units. J Compr Ped. 2019;10(2):e82830.
12. Mathews S, Rajan A, Soans ST. Prognostic value of rise in neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) in predicting the mortality in paediatric intensive care. Int J Contemp Pediat. 2019;6(3):1052–1058
13. Karam O, Demaret P, Duhamel A, Shefler A, Spinella PC, Stanworth SJ, et al. Performance of the pediatric logistic organ dysfunction-2 score in critically ill children requiring plasma transfusions. Ann Intensive Care. 2016;6(1):98.

Cite this article as: Gobbur S, Badakali A, Pol R, Neelannavar R. Utility of paediatric logistic organ dysfunction score in predicting mortality in children admitted to PICU at a tertiary care centre. Int J Contemp Pediatr 2023;10:1057-60.