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ORIGINAL RESEARCH

PELOD-2 score predicts mortality in patients admitted to the intensive care unit at Hospital Baca Ortiz from March to August 2018.

Ana María Pazmiño Miranda[1], David Israel Reinoso Recalde[2], Luis Stalin Donoso León[2].

https://orcid.org/0000-0003-1206-8742 https://orcid.org/0000-0002-3985-7066 https://orcid.org/0000-0002-4208-6805

1. Pediatric Service, Apolo Medical Specialties Center, Quito, Ecuador
2. Intensive Care Unit, Hospital Pediátrico Baca Ortiz, Ministry of Public Health, Quito, Ecuador

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Abstract

Introduction: Multiorgan dysfunction syndrome (MODS) is a failure of two or more organs in critically ill patients, and scores have been created to estimate mortality in these patients. The aim of the present study was to determine the diagnostic value of the Pediatric Logistic Organ Dysfunction-2 (PELOD-2) scale to predict mortality in patients who were admitted to the intensive care unit (ICU) at the Hospital Baca Ortiz.

Methods: This analytical observational study was conducted in the ICU at the Hospital Pediátrico Baca Ortiz, Quito, Ecuador from March to August 2018. All possible analyzable cases were included, and they were divided into the following groups: Group 1 (G1), deceased children; and Group 2 (G2), surviving children. Analyzed variables were gestational age, sex, clinical variables of the PELOD-2 score, and mortality. The sensitivity (S), specificity (S), positive predictive value (PPV), and negative predictive value (NPV) were calculated for each score.

Results: There were 188 cases included. There were 97 females (51.6%) and 66/188 patients aged 1 to 4 years (35.1%). There were 100/188 cases with respiratory failure (53.7%) and 35/188 patients died (18.6%; 95% confidence interval [CI] 18.21–19.02%). PELOD-2 ≥16 was associated with 63% mortality (OR 511.7, 95% CI 29.4–8909; P <0.0001). Additionally, S was 62.9%, E was 100%, PPV was 100%, NPV was 92.2%, and accuracy was 93.1%.

Conclusion: The PELOD-2 score is an acceptable, highly specific predictor of mortality.

Keywords: Intensive care units, multiple organ failure, children, Pediatric Logistic Organ Dysfunction-2 Score, PELOD-2.

* Corresponding author.

Email:davidirr89.dr@gmail.com (David Reinoso Recalde) / Phone: +593 9922 80295 S / N and D.M., Avenida 6 de Diciembre & Av. Cristóbal Colón, Hospital Baca Ortiz, Quito, Ecuador.

Introduction

The term multi-organ failure (MOF) was coined 20 years ago to describe the almost always fatal course of trauma patients who progress into respiratory, hepatic, and renal failure. Subsequently, other clinical and surgical pathologies such as sepsis, shock, pancreatitis, and burns were found to evolve into MOF, even after their initial pathology was resolved [1].

Multi-organ dysfunction syndrome (MODS) is currently defined as a failure of two or more organ systems that are unable to spontaneously maintain their activity. This syndrome is common in critically ill patients, and it is associated with significant mortality, making it the leading cause of death of children and adults in intensive care units [2]. Despite these high mortality rates, there have only been a few studies that have been conducted. In our country in 2012, the incidence and prognosis of multi-organ dysfunction in the intensive care area of the Hospital de Niños Dr. Roberto Gilbert in Guayaquil was evaluated, and 53.7% of the admitted patients presented MODS, with a mortality rate of 18.8%. Of the total number of deaths, 69.9% were male, and most were breastfeeding infants (41.3%). The respiratory system had the most complications (98.6%), and infectious diseases (45.5%) was the main cause of admission, which in turn caused the highest mortality (30.5%) [3].

Thus, to comprehensively study this pathology, mortality risk scales have been developed. Their evaluation parameters include physical signs and complementary laboratory tests that allow evaluation of the state in which the patient is admitted, and they are the basis for the patient's prognosis [4].

The main score that is used in the pediatric intensive care units is the Pediatric Logistic Organ Dysfunction (PELOD), which was developed in 1999 to primarily describe the severity of MODS and provide adequate information on the progression of this pathology during hospitalization. However, in 2013, Leteurtre et al. published an update of the score in a larger and more current sample, and they called it PELOD-2. The PELOD-2 score includes an assessment of the mean arterial pressure and lactic acid level, but excludes liver dysfunction due to its low prevalence in pediatric patients. Therefore, this new version has ten variables corresponding to five organ dysfunctions [5].

The maximum value of PELOD-2 is 33 and the maximum number of points to determine organ failure is 10, which is considered to be a validated score with good discrimination ability and calibration. Therefore, the purpose of the present investigation was to analyze the PELOD-2 score as a predictor of mortality for pediatric patients who are admitted to the intensive care unit at the Hospital Pediátrico Baca Ortiz with a diagnosis of MODS syndrome from March to August 2018.

Population and methods

Study design

The study was an observational, analytical study.

Stage

The study was conducted in the intensive care unit at the Hospital Pediátrico Baca Ortiz Quito, Ecuador between the March 1, 2018 and August 30, 2018. The study period was considered to include the recruitment and exposure periods.

Outcomes monitoring was completed on September 24, 2018, and the data collection period ended on October 24, 2018.

Participants

All patients under 15 years of age who were admitted to the intensive care unit of the institution during the study participated. Patients with complete medical history data that included a diagnosis of MODS were selected. Patients who transferred from other intensive care units, patients with incomplete data records that did not allow calculation of the PELOD-2 score, and preterm neonatal patients were excluded.

Variables

Described variables were PELOD-2, sex, age, nutritional status, ethnicity, residence area, nationality, type of organ failure, survival, economic level, the patient's family type, parents' educational level, and patient's educational level.

Data sources and measurement

For each variable, the institutional software for recording medical records was used as a data source. The

electronic medical records and the laboratory software were consulted for data extraction.

The data were compiled using an electronic sheet and were then transferred to the statistical software.

Controlling sources of bias

Medical records with incomplete data were excluded, and no imputation of missing or excluded data was performed. The study protocol was pre-approved by the Institutional Teaching Committee.

Study size

The sample was non-probabilistic, and all potentially eligible cases from the pediatric hospital were included.

Handling quantitative variables

Scaled quantitative variables are presented as the mean and standard deviation. Nominal quantitative variables are presented as the frequency and percentage. For the corresponding analysis, deceased patients (Group 1) and surviving patients at the end of treatment (Group 2) were compared.

Statistical methods

The averages were compared using a Student's t-test. Percentages were compared using the Chi-square test. Sensitivity, specificity, and the positive and negative predictive value were calculated. The statistical package used was SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp, USA.

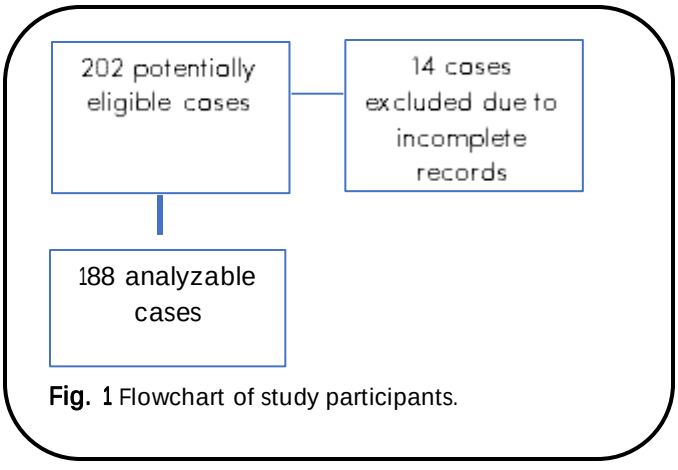

Fig. 1 Flowchart of study participants.

Results

Participants

There were 188 patients included in this study. Patients who were not included in the study are presented in Fig. 1.

Table 1 Socio-demographic characteristics of the study group.

	Frequency	(%)	Ratio 95% CI
Age (years)			
Less than 1	43	22.9	22.4-23.3
1 to 4	66	35.1	34.6-35.6
5 to 9	42	22.3	21.9-22.8
10 to 15	37	19.7	19.3-20.1
Sex			
Male	97	51.6	51.1-52.2
Female	91	48.4	47.9-48.9
Family type			
Nuclear	149	79.3	78.8-79.7
Single parent	36	19.1	18.7-19.6
Reconstituted	3	1.6	1.5-1.7
Ethnicity			
Mixed race	166	88.3	88.0-88.6
Indigenous/other	22	11.7	11.4-12.0
Residence			
Rural	67	35.6	35.1-36.1
Urban	121	64.4	63.9-64.9
Nationality			
Ecuadorian	181	96.3	96.1-96.5
Other	7	3.7	3.5-3.9
Economic level			
Low	98	52.1	51.6-52.7
Medium/high	90	47.9	47.4-48.4
Parents' education level			
Primary	85	45.2	44.7-45.7
High school	88	46.8	46.3-47.3
Higher	15	8	7.7-8.3
Patient's educational level			
Under 4 years	109	58	57.5-58.5
Illiterate	1	0.5	0.46-0.61
Primary	54	28.7	28.3-29.2
Secundaria	24	12.8	12.4-13.1

CI, confidence interval

Characteristics of the study population

There were 97 females (51.6%) and 91 males (48.4%) who were enrolled into this study. The largest group was patients aged 1 to 4 years (66/188; 35.1%) (see Table 1).

Clinical features

Nutritional status was normal in most cases (101/188; 53.7%), and the most common failure was respiratory failure (100/188; 53.7%). Additionally, 35 of 188 patients died (18.6%; 95% CI 18.21–19.02%) (see Table 2).

Table 2 Clinical characteristics of the study group.

	Frequency	(%)
Nutritional status		
Normal	101	53.7
Malnutrition	84	44.7
Overweight	3	1.6
Initial diagnosis (failure)		
Cardiac	20	10.6
Respiratory	100	53.2
Renal	12	6.4
Liver	3	1.6
Gastrointestinal	12	6.4
Neurological	37	19.7
Hematological	4	2.1
Survival		
Died	35	18.6
Alive	153	81.4
PELOD-2		
Mean ± SD	9.7 ± 3.9	
Minimum	2	
Maximum	21	
Range	19	

A statistically significant association was established between a high PELOD-2 score and mortality (Table 3). A score of greater than 16 was considered to be a risk factor for death compared to patients with a lower value.

Table 3 Association between mortality and the PELOD-2 score.

	Group 1 (Deceased) n = 35	Group 2 (Alive) n = 153	OR	95% CI	P
PELOD2	16.14 ±1.46	8.29 ±2.73	511.7	29.4-8909	<0.0001
PELOD2 ≥16	22 (63%)	0 (0%)			
PELOD2 <16	13 (37%)	153 (100%)			

PELOD-2, Pediatric Logistic Organ Dysfunction-2; OR, odds ratio; CI, confidence interval

Main results

The prevalence was 18.6 (95% CI 18.21–19.02). The sensitivity was 62.9 (95% CI 62.35–63.36), and the specificity was 100%. The false-negative rate was 37.1 (95% CI 36.64–37.65), and the false-positive rate was 0. The positive predictive value was 100%, and the negative predictive value was 92.2 (95% CI 91.89–92.45). The accuracy was 93.09 (95% CI 92.82–93.35), and the negative likelihood ratio was 0.371. The Youden index was 0.629

Discussion

MODS is a severe and highly fatal event that is defined as a continuous, reversible process, and it comprises sequential vital organ failure secondary to an injury that disrupts general homeostasis. It is considered to be the leading cause of death in pediatric and adult intensive care units [3].

To predict the risk of mortality from this pathology in children, predictive scales or severity scores have been developed, which help to objectively summarize subjective data that are difficult to measure [6, 7]. The present study validated the PELOD-2 score, assessing the association between mortality and a high PELOD-2 score on the first day of hospitalization in patients who were admitted to the PICU. There was a statistically significant association between these two parameters (P<0.0001), with a mortality of 18.6% (group 1; n = 35) and survival rate of 81.4% (group 2; n = 153).

Several studies indicate that PELOD-2 has a good ability to distinguish between mortality and survival compared to the PRIMS III8. Previous studies also reported a statistical association between a high PELOD-2 score and significant mortality [8-10].

Leteurtre et al. also found that this score was significantly higher in non-survivors than in survivors (P<0.0001), emphasizing that all the organic dysfunctions that were retained in this score are closely related to the mortality risk, with a mortality rate of 6.1% [7]. Among the 1261 enrolled patients with MODS on day 1, the syndrome worsened in 157 (12.4%) patients and remained unchanged or improved in 1104 (87.6%) patients, which demonstrates that the PELOD-2 score on day 1 is a significant prognostic factor and that mortality was higher in children in whom MODS worsened after day 1 compared to those in whom it remained unchanged or improved [11].

Ramazani and Hosseini showed that the PELOD-2 score was significantly different between non-survivors and survivors. Non-survivors showed significantly higher values than survivors (P<0.001) [12].

Progression of MODS severity can be assessed by measuring the PELOD-2 scores daily, which would also serve as a useful measure to estimate response to therapy [11, 12].

In the present study, a cut-off point of 16 was established for the PELOD-2 score, with good study specificity. Other studies have established different cut-off points with a value of 5 for survivors and a score of 11, 12, and 15, with references of [13, 10, 11] respectively for non-survivors in different studies.

Nationally, a cut-off point of 10 has been reported for significant differences in survival [3]. Alternatively, a PELOD-2 greater than or equal to 8 is already associated with a mortality rate of 22.2% [14].

Another study that was conducted at the Hospital Surakarta in Indonesia defined a score of 20 with a relative risk of 7.75 (95% CI 3.1–19.3; P<0.001) [15].

The number of organic dysfunctions is another important point because, as several studies mentioned, the greater the number of organs that are in failure, the greater is the risk of death. In a study that was performed in Cuba, failure of three to four organs predominated, and at a pediatric hospital in Venezuela, a mortality rate of 19% was reported for three organ failures and 50% for four or more organ failures [3]. Additionally, Dewi and Fatimatuzzuhroh showed that higher organ failure values are associated with a mortality rate of 30.5% if there are four organic dysfunctions and 59% with five organic dysfunctions [10].

For the age group, this pathology was more frequent in older breastfeeding infants and preschoolers (1 to 4 years of age) with 35.1% of patients affected (n = 66). Similar data were found in a study that was conducted in 2012 at the Hospital Roberto Gilbert in Guayaquil where MODS predominated in infants (41.3%), followed by preschoolers (29.7%). Dewi and Fatimatuzzuhroh showed that children under 1 year of age were mostly affected (27.9% of patients) [10].

In the present study, male sex was most frequently affected (51.6%; n = 97), which is similar to that reported in other studies [3].

In the present study the most frequent initial diagnosis was respiratory failure in 53.2% of patients (n = 100), followed by neurological failure in 19.7% (n = 37) and heart failure in 10.6% (n = 20). These results are similar to those that were reported regionally where respiratory system failure was present in 98.6% of all patients, followed by neurological failure in 93.9% and cardiovascular failure in 60.6% [3].

Living in a rural area is considered to be a statistically significant risk factor for death (P = 0.01).

This study showed that the PELOD-2 score has a sensitivity of 62.8% and a specificity of 100%, which is similar to the results found by Tressa et al. (2018) who found a sensitivity of 76.9% and a specificity of 100%15. The present specificity and sensitivity findings differ from other series where sensitivity was reported to be 88%, specificity was 66%, and accuracy was 70%12, and where the sensitivity was 88.1% and specificity was 55.7% [13]. The PELOD-2 daily score is a useful tool for stratifying critically ill children, describing their clinical course, estimating therapeutic responses, and describing outcomes. It could also be used for epidemiology and management purposes.

Conclusion

PELOD-2 is a useful score for determining mortality in patients with MODS in the pediatric intensive care unit. The PELOD-2 has an acceptable sensitivity and very good specificity.

Abbreviations

PELOD-2, Pediatric Logistic Organ Dysfunction-2.
MODS, multiorgan dysfunction syndrome.

Acknowledgments

Not applicable.

Authors' contributions

AMPM, DIRR, and LSDL worked equally to develop the research idea. AMPM and DIRR performed the literature review, data collection, and writing of the paper. AMPM performed the critical analysis of the article. DIRR made the editorial corrections. All authors read and approved the final version of the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due participant confidentiality but are available from the corresponding author on reasonable request.

Ethical statements

Protection of persons

The authors declare that the procedures followed were in accordance with the ethical standards of the responsible human experimentation committee and in accordance with the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data

The authors declare that they have followed the protocols of their work center on the publication of patient data.

Consent for publication

The patients' parent or legal guardian provided consent for this research.

Competing interests

The authors have no competing interests to declare

References

1. Casado J, Mora E. Fracaso disfunción multiorgánica. An Esp Pediatr 1996;45(6):563-569. **SU**: aeped.45-6-2

2. Carbayo T, de la Mata A, Sánchez M, López-Herce J, del Castillo J, Carrillo A, et al. Fallo multiorgánico tras la recuperación de la circulación espontánea en la parada cardiaca en el nino. Anales de Pediatría 2017;87(1):34-41. **DOI**: 10.1016/j.anpedi.2016.06.010

3. Cevallos Cedeño A. Incidencia y pronostico de disfuncion multiorgánica en la área de la UCIP del Hospital de niños Dr. Roberto Gilbert en el 2012. [Tesis Postgrado]. Repositorio Digital de la Universidad Católica Santiago de Guayaquil; 2013. **SU**: dspace.ucsg/3317/959

4. Doctor A, Zimmerman J, Agus M, Rajasekaran S, Bubeck Wardenburg J, Fortenberry J, et al. Pediatric Multiple Organ Dysfunction Syndrome: Promising Therapies. Pediatr Crit Care Med. 2017;18(3_suppl Suppl 1):S67-S82. **DOI**: 10.1097/PCC.0000000000001053. PMID: 28248836.

5. Arias M. Escalas de evaluación pronóstica y de intervención en la unidad de cuidados intensivos pediátricos. Manual de Cuidados Intensivos Pediátricos [Internet]. Sociedad Latinoamericana de Cuidados Intensivos Pediátricos. 2020 [citado 16 febrero 2019]. **SU**: slacip/manual

6. Fernández R, Macuarisma, P. Validación de dos escalas de valor pronóstico en los niños que ingresan a la uci. Archivos venezolanos de puericultura y pediatría. 2010;37(4):3-4. **SU**: scielo.veS0004-0649201

7. 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. **DOI**: 10.1097/CCM.0b013e31828a2bbd. PMID: 23685639.

8. Gonçalves JP, Severo M, Rocha C, Jardim J, Mota T, Ribeiro A. Performance of PRISM III and PELOD-2 scores in a pediatric intensive care unit. Eur J Pediatr. 2015 Oct;174(10):1305-10. **DOI**: 10.1007/s00431-015-2533-5. Epub 2015 Apr 15. PMID: 25875250.

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. Jornal de Pediatria 2020;96(5):660-665. **DOI**: 10.1016/j.jped.2019.07.007

10. Dewi R, Fatimatuzzuhroh F. Critically Ill Patient's Profile in Pediatric Intensive Care Unit Cipto Mangunkusumo Hospital Based on Pediatric Logistic Organ Dysfunction-2. Sari Pediatri, 2019;21(1).37-42. **DOI**: 10.14238/sp21.1.2019.37-43

11. Leteurtre S, Duhamel A, Deken V, Lacroix J, Leclerc F; Groupe Francophone de Réanimation et Urgences Pédiatriques. Daily estimation of the severity of organ dysfunctions in critically ill children by using the PELOD-2 score. Crit Care. 2015 Sep 15;19(1):324. DOI: 10.1186/s13054-015-1054-y. PMID: 26369662; PMCID: PMC4570178.

12. Ramazani J, Hosseini M. Comparison of the Predictive Ability of the Pediatric Risk of Mortality III, Pediatric Index of Mortality3, and Pediatric Logistic Organ Dysfunction-2 in Medical and Surgical Intensive Care Units. Journal of Comprenshible Pediatrics 2019;10(2):e82830. **DOI**: 10.5812/compreped.82830.

13. Dauhan AC, Lubis AD, Mutiara E, Lubis M. Correlation of Troponin Level (Troponin T, Troponin I) With PELOD-2 Score in Sepsis as a Predictive Factor of Mortality. Open Access Maced J Med Sci. 2019;7(23):4072-4077. **DOI**: 10.3889/oamjms.2019.806. PMID: 32165955.

14. Schlapbach LJ, Straney L, Bellomo R, MacLaren G, Pilcher D. Prognostic accuracy of age-adapted SOFA, SIRS, PELOD-2, and qSOFA for in-hospital mortality among children with suspected infection admitted to the intensive care unit. Intensive Care Med. 2018

Feb;44(2):179-188. **DOI**: 10.1007/s00134-017-5021-8. Epub 2017 Dec 19. PMID: 29256116; PMCID: PMC5816088.

15. Tressa B, Sri M, Harsono S. Perbandingan Prediktor Mortalitas Skor PRISM III dan PELOD 2 pada Anak Sakit Kritis Non Bedah. Sari Pediatri. 2018;19(5):284-288. DOI: 10.14238/sp19.5.2018.284-9

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