

ORIGINAL ARTICLES

PREDICTING MORTALITY IN PEDIATRIC INTENSIVE CARE UNIT USING PEDIATRIC LOGISTIC ORGAN DYSFUNCTION SCORE IN A TERTIARY CARE CENTRE*Jyotirmanju CS, Sunil kumar BM, Prarthana Karumbaiah, ATK Rau***Abstract**

Aim: To predict mortality rate in children with multiple organ dysfunction (MODS) admitted to Pediatric Intensive Care Unit (PICU), using an externally validated score pediatric logistic organ dysfunction score (PELOD).

Design and Setting: Longitudinal observational study in a tertiary care medical college centre.

Methods: The study was conducted in 328 children (177 boys and 151 girls) in the age group of 1month to 14yrs admitted in the PICU. Data on the variables of PLEOD score, such as pulse rate, blood pressure, Glasgow coma scale (GCS), pupils were recorded on day 1. Hematological investigations [total count, platelet count, prothrombin time (PT), partial thromboplastin time (APTT), creatinine, ALT, and arterial blood gases] were done by standard laboratory techniques. Patients were followed up during the hospital stay and the outcome measures were recorded as died or survived at the end of the hospital stay. To calculate the PELOD score, each organ system received points for the single variable associated with the most points. The maximum number of points for an organ system is 4, and the maximum possible PLEOD score is 28.

Results: Overall mortality rate was 40 (12.2%). The odds ratio for mortality for four and more than four organ dysfunction was found to be 265.57 as compared to less than four organ dysfunction ($p=0.001$). The odds ratio for mortality with PELOD score of >20 was 3.5 (95% CI 1.54 to 8.01) as compared to the score less than 20. The differences in the mortality of the children whose score was less than 20 compared to more than 20 [30 (10.2%) vs 10 (28.6%)] was found to be statistically significant ($p=0.002$).

Conclusion: Mortality rate and the PELOD score increased with the number of organ dysfunction. PELOD score is definitely a good predictor of mortality, but it underscores morbidity.

Key words: PELOD, MODS, Septicemia, PICU, Mortality.

Introduction

Patients admitted to intensive care units (ICUs) usually have some organ dysfunction.(1-4) Adult and pediatric studies have shown that mortality increases with the number of organs involved.(2,4,5) Thus, multiple-organ dysfunction syndrome (dysfunction involving two or more organs) has been viewed as the inexorable pathway to death.(6) Infections leading to multiple organ dysfunction syndromes (MODS) are high in children. Sepsis increases the risk of mortality in children with multiple organ failure.(4) The reported frequency of multiple organ dysfunctions in pediatric intensive care units (PICUs) varies between 11-27%.(3,4) Hence there is a need for developing an objective measure of MODS in PICU. The pediatric logistic organ dysfunction score (PELOD) was developed as an outcome measure in PICU by Leteurtre et al in 1999 and also the score was

validated by the same group.(3,7) In the PELOD, score markers of organ dysfunction are graded according to severity of derangement and assigned a score which is then summed up in a composite score. Since MODS is closely associated with PICU mortality, the PELOD score - which is derived from MODS criteria -can be considered as a surrogate for probability of death. (8-14) The PELOD score has been validated in PICUs in France, Canada and Switzerland.(9) However there are not many studies done in developing countries like ours supporting the same.

Methods and materials

Data were collected from a tertiary care hospital PICU, manned by pediatric intensivists, consultants and pediatric residents round the clock, after the approval from the institutional review board. The study period was between January 2011 - December 2011. We prospectively included 328 patients from the age group 1month to 14 yrs of either sex, after taking the informed consent of the parents. Children with congenital malformations, surgical problems and those discharged against medical advice where the outcome could not be measured were excluded. Data were collected in predesigned collection sheet and included the demographic characteristics, reason for admission and intensive care outcome. The data on the variables of PLEOD score, such as vital parameters pulse rate, blood pressure, Glasgow Coma Scale (GCS), pupillary reaction to light were recorded on day one by the resident doctor. Hematological investigations [total count, platelet count, prothrombin time (PT), creatinine, liver enzymes, arterial blood gas (ABG)] were done on an individual case basis by standard laboratory techniques. Patients were followed up during the hospital stay and the outcome measures were recorded as died or survived at the end of the hospital stay. The physiological data collected during the preterminal period in dying patient were not considered for the analysis.

Sample size: Study carried by Thukral et al(15) indicated that nearly 35% of the patients admitted to ICU had MODS. The sample size for the present study has been estimated based on the above study with a relative precision of 15% and confidence level of 95%. The estimated sample size worked out to be 320. Hence it is proposed to include 320 patients admitted to PICU with MODS. The scores were dichotomized into 2 groups of cases, group 1 having score < 20 and group 2 having scores ≥ 20 .

Validity of PELOD score to predict outcome in MODS was analyzed applying chi square test and odds ratio using SPSS.18 software. To calculate the PELOD score, each organ system received points for the single variable associated with the most points. The maximum number of points for an organ system is 4, and the maximum possible PLEOD score is 28. Organ dysfunction identified if the score for any organ system was more than 0. The predicted mortality rate was calculated by the following equation:

Logit = - 7.64 + 0.3x pelod
 Predicted death rate = 1/(1+e-logit)

Following parameters were covered as determined by PELOD score:

- Cardiovascular system: heart rate, systolic blood pressure.
- Central nervous system : GCS score, pupillary reflex to light (reactive/fixed)
- Respiratory system: mechanically ventilated or not, ABG (Pao₂, Pa co₂, pH)
- Hematological tests: total counts, platelets
- Liver : ALT ,INR
- Renal system : serum creatinine

Results

Male: female ratio was 1.17:1. Sepsis was the primary diagnosis in 101 (30%) cases, 91(28%) were admitted for severe respiratory distress/pneumonia, 68(20.5%) cases were admitted for shock with viral hemorrhagic fever, 68(20.7%) had central nervous system infections. The overall mortality rate was 40 (12.2%) and the mortality rate was 14.8% in children diagnosed to have sepsis. Relation between the number of organ dysfunctions, PELOD score and mortality is depicted in Table 1. The differences in the proportion of death taking place with the number of organ failures was found to be statistically significant (p =0.001). The odds ratio for mortality with four and more than four organ dysfunction was found to be 265.57 as compared to less than four organ dysfunction. Relationship between PELOD score >20 and <20 is depicted in Table 2. The odds ratio for mortality with PELOD score of >20 was 3.5 (95% CI 1.54 to 8.01) as compared to the score less than 20.

Table 1: Relation between the number of organ dysfunctions, PELOD score and mortality

Number of organ dysfunction	Patients (N=328)	Mean PELOD score	Deaths (%)
1	0	0	0 (0)
2	138	14	0 (0)
3	119	18.3	2 (0.01)
4	43	21.8	12 (27.9)
5	24	20.5	22 (91.6)
6	4	22.3	4 (100)

Table 2: Relationship between PELOD score > 20 and the outcome

	Survived	Died	P value
PELOD score <20	263 (89.8%)	30 (10.2%)	p=0.002
PELOD score >20	25 (71.4%)	10 (28.6%)	

Discussion

The overall mortality rate in our study was 12.2% in our centre. It is comparable to other studies.(15) Most common cause of PICU admission was sepsis in our study and the mortality rate was 14.8% in children diagnosed to have sepsis. This was comparable to other studies.(3-6) Sepsis-associated mortality in children decreased from 97% in 1966(7) to 9% among infants in the early 1990s.(8) A recent population-based study by Watson et al(9) of US children with severe sepsis (bacterial or fungal infection with at least one acute organ dysfunction) reported more than 42,000 cases in 1995 with a mortality rate of 10.3%. Although this represents a significant improvement over the past few decades, severe sepsis remains one of the leading causes of death in children.

The relationship between mortality rate and PELOD score was good in our study with mortality rate being 27.9% with 4 organ systems involved which increased to 91.6% with 5 organ systems involvement and further to 100% with six organ system involvement. This is comparable to other studies.(2) The mortality was directly proportional to the number of organ dysfunction and the PELOD score also increased with number of organ dysfunction. This was comparable to other studies.(15)

We had few limitations in our study. Firstly ours being a tertiary care centre we had majority of the sick children being referred to the PICU late, with multiple organ dysfunction already set in. Secondly, our study is carried out in one PICU of a tertiary care centre in south India unlike other studies which were done in multiple centres. Third, limitation was a sample size. Fourth limitation could have been a treatment bias. PELOD score includes data that can be modulated by the care provided during PICU and hence cannot differentiate between therapy and severity of the disease. This finding was similar to other studies.(9)

Conclusion

The mortality rate and the PELOD score correlated well. PELOD score is a good predictor of mortality, but it underscores morbidity.

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From: Department of Pediatrics, M S Ramaiah Medical College, Bangalore. India.

Address for Correspondence: Dr. Jyotirmanju, Assistant Professor, Department of Pediatrics, MS Ramaiah Medical College, Bangalore. Email: jyotirmanju@gmail.com.

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