SRMS IMS

10.21761/jms.v10i1.07

ORIGINAL RESEARCH ARTICLE

Prognostic Evaluation of Multi-Organ Dysfunction Syndrome in Pediatric Intensive Care Unit: A Cross-sectional Study from Western UP

Namrata Rai[1], Surabhi Chandra[2*], Rajeev Kumar Pandey[3#], Tanveer Nain[3], Mayank Gupta[3], Anjali Mishra[3], Karishma Aggarwal[3], Disha Gupta[3], Cheerla Suresh[3]

ABSTRACT

Introduction: Multi-organ dysfunction syndrome (MODS) significantly contributes to pediatric mortality, especially in low- and middle-income countries. The aim of the study is to evaluate the prognostic utility of the pediatric logistic organ dysfunction (PELOD) score in patients with MODS in Western UP and to study their clinical and laboratory profiles.

Material and Methods: A cross-sectional observational study was conducted over 12 months in a tertiary care Pediatric Intensive Care Unit (PICU) in North India, including children aged 1 month to 12 years diagnosed with MODS.

Results: Among 94 patients, the majority were male (72.34%) and from rural, lower socioeconomic backgrounds. Sepsis was the leading cause of MODS (95.74%). Higher PELOD scores correlated with increased mortality and longer hospital stays.

Conclusion: MODS remains a critical concern in pediatric care. The PELOD score is a valuable tool for prognostication and should be integrated into routine clinical practice.

Keywords: Multi-organ dysfunction syndrome, Pediatric intensive care unit, PELOD score, Sepsis, Prognosis.

How to cite this article: Rai N, Chandra S, Pandey RK, Nain T, Gupta M, Mishra A, Aggarwal K, Gupta D, Suresh C. Prognostic Evaluation of Multi-Organ Dysfunction Syndrome in Pediatric Intensive Care Unit: A Cross-sectional Study from Western UP. SRMS J Med Sci 2025;10(1):34-38.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Multi-organ dysfunction syndrome (MODS) is a severe, life-threatening condition significantly contributing to pediatric mortality, especially in low- and middle-income countries[1] characterized by the progressive failure of two or more organ systems.[2] In pediatric populations, MODS is a leading cause of morbidity and mortality, particularly where healthcare resources are often limited. The pathophysiology of MODS is complex, involving a dysregulated inflammatory response to various insults, including infections, trauma, and systemic diseases.

Sepsis is the most common precipitating factor for MODS in children, accounting for a significant proportion of cases.[3,4] The early identification and management of MODS are crucial for improving outcomes. Various scoring systems have been developed to assess the severity of organ dysfunction and predict outcomes in critically ill children. Among these, the pediatric logistic organ dysfunction (PELOD) score has been widely validated and is considered a reliable tool for prognostication in pediatric intensive care settings.[5]

Despite the availability of such tools, there is a paucity of data from LMICs, including India, regarding the clinical and laboratory profiles of pediatric MODS and the utility of the PELOD score in these settings. This study aims to fill this gap by evaluating the clinico-laboratory characteristics and prognostic outcomes of MODS in a pediatric intensive care unit in North India.

MATERIAL AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted over a period of 12 months in the pediatric intensive care unit (PICU) of a tertiary care hospital in Western UP. The Institutional Ethics Committee approved the study.

Children aged 1 month to 12 years admitted to the PICU with a diagnosis of MODS, defined as the dysfunction of two or more organ systems,[2] were included in the study after taking consent from parents/guardians. Exclusion criteria were Children with terminal illnesses where care was palliative. Patients with incomplete medical records.

Upon admission, detailed clinical histories were obtained, and thorough physical examinations were conducted. Laboratory investigations included complete blood counts, liver and renal function tests, coagulation profiles, and cultures (blood, urine, and tracheal aspirates). The PELOD score was calculated on admission and subsequently every 24 hours until the final outcome, i.e., discharge (good outcome) or death (poor outcome).

Submission: 02-04-2025; **Acceptance:** 05-05-2025; **Published:** 30-06-2025

[1]Senior Resident ,[2]Professor, [3]Junior Resident, Department of Paediatrics, [#]Department of General Medicine

Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India.

***Corresponding Author:** Surabhi Chandra, Professor, Department of Paediatrics, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India, Email: surabhi0329@gmail.com

Statistical Analysis

Data were analyzed using SPSS version 25.0. The chi-square test was used for categorical variables, and the Student's t-test for continuous variables. A *p-value* of <0.05 was considered statistically significant.

RESULTS

A total of 94 pediatric patients fulfilling the inclusion criteria for multi-organ dysfunction syndrome (MODS) were enrolled during the study period (August 2022 – April 2024). The mean age of the cohort was 9.04 ± 5.26 years. The most commonly affected age group was 1 to 5 years (n=34, 36.2%), followed by 11 to 15 years (n=27, 28.7%), 6 to 10 years (n=19, 20.2%), and >15 years (n=14, 14.9%) (Figure 1). There was a male predominance with 68 male patients (72.3%) and 26 females (27.7%), yielding a male-to-female ratio of 2.6:1.

Most children (n=55, 58.7%) were from rural areas, and a majority (n=77, 82.2%) belonged to the lower socioeconomic class as per the modified Kuppuswamy scale (Figure 2). Sepsis was the most prevalent etiological factor (n=90, 95.7%), followed by shock (n=65, 69.1%), hypoxemia (n=37, 39.4%), and multiple blood transfusions (n=20, 21.3%). The most frequently reported clinical symptoms at admission were altered sensorium (n=47, 50%), breathing difficulty (n=42, 44.7%), seizures (n=35, 37.2%), and palpitations (n=37, 39.4%) (Figure 3). On general examination, pallor (n=41, 43.6%) and icterus (n=34, 36.2%) were common findings. Hepatosplenomegaly was observed in 64 patients (68.1%) and bilateral chest retractions in 58 (61.7%).

Median hemoglobin was 8.2 g/dL (IQR: 3.4), and median platelet count was 1.8 lakh/mm^3 (IQR: 0.89). Elevated liver enzymes were noted with a median SGOT of 370 IU/L and SGPT of 209 IU/L. The median prothrombin time (PT) was 19.7 seconds, and INR was 1.5. Median C-reactive protein (CRP) was 108 mg/dL (IQR: 122.5), and median serum ferritin was 1155.4 ng/mL (IQR: 3424.55).

Blood culture was sterile in 65.6% (n=59) of cases. Among positive cultures, MRSA was most commonly isolated (n=17, 18.8%), followed by *E. coli* (n=14, 15.6%). *Acinetobacter baumannii* was isolated in 40% of ET tip cultures.

The mean PELOD score on the day of admission was 11.03 ± 15.64. Mean of maximum PELOD scores recorded during the hospital stay was significantly higher at 14.85 ± 16.75. MODS was identified on Day 1 in 54 (57.4%) patients, day 2 in 23 (24.5%), and day 3 in 17 (18.1%) (Table 1).

Maximum PELOD score during the hospital stay was significantly higher in patients with a poor outcome (mean = 27.29 ± 18.64) compared to those with a good outcome (mean = 7.93 ± 11.16); $p < 0.0001$ (independent t-test). PELOD score at admission was significantly higher in patients with poor outcome (mean = 19.48 ± 19.35) versus good outcome (mean = 6.45 ± 10.52); $p = 0.0001$.

The maximum PELOD score was also significantly associated with a longer PICU stay (mean = 9.15 ± 6.50 days); p = 0.002. However, PELOD score at admission did not show a statistically significant association with the length of stay (p = 0.416).(Table 2). Table 3 shows that out of 94 patients, 61 (64.9%) had a good outcome (discharged), while 33 (35.1%) had a poor outcome.

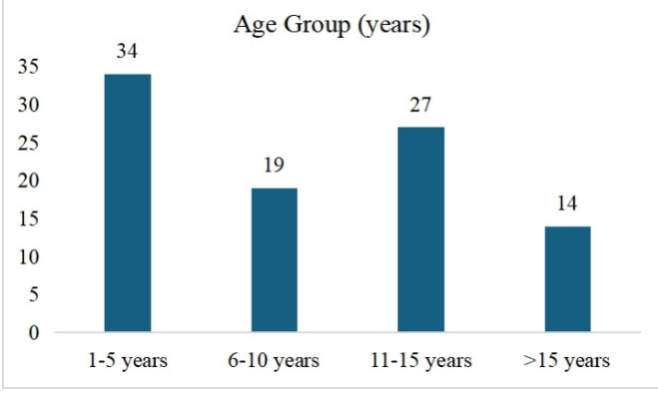
Table 4 shows that the mean duration of PICU stay was 9.15 ± 6.50 days. While PELOD at admission did not predict length of stay, maximum PELOD scores correlated positively with increased duration of PICU stay.

DISCUSSION

This study highlights the significant burden of MODS in pediatric patients. The mean age of children with MODS in our study was 9.04 ± 5.26 years, with the majority (36.2%) aged between 1 to 5 years. This is in line with findings from Punia *et al.*,[6] who also reported that nearly half of their patients with MODS were aged between 1 to 10 years. Other studies, such as those by Dewi Metta *et al.*[7] and Lulu Hona *et al.*[8] reported even younger mean ages (approximately 3–4 years), indicating that MODS can affect a wide pediatric age spectrum. The higher mean age in our study could reflect delayed referrals or differences in PICU admission practices.

A male predominance was observed (72.3%), consistent with studies by Khilnani *et al.*[3] and Iqbal H *et al.*[9], which reported male-to-female ratios of 1.65:1 and 1.78:1, respectively. This trend may reflect sociocultural factors influencing healthcare-seeking behavior in our region, where male children often receive preferential medical attention.

The majority of our patients were from rural areas (58.7%) and belonged to lower socioeconomic classes (82.2%). Similar socioeconomic disparities have been



1: Age Distribution of patients admitted in PICU with MODS

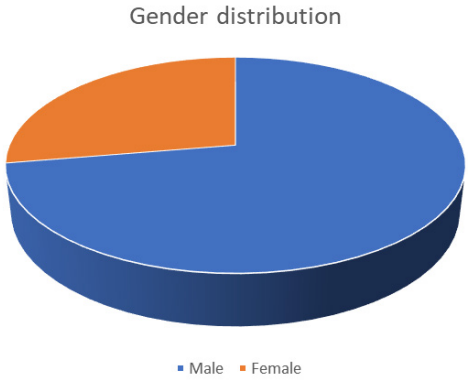


Fig 2: Gender distribution of patients admitted in PICU

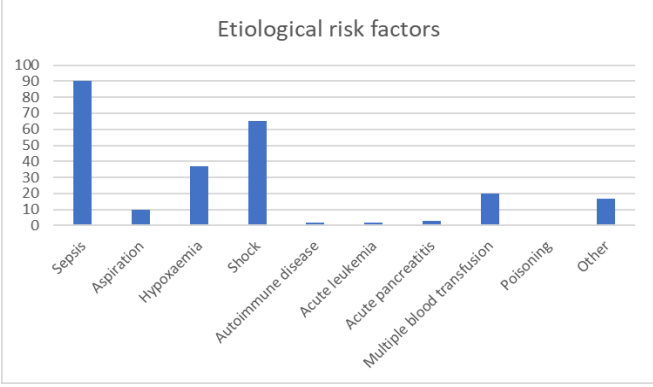


Fig 3: Etiological Risk factors of patients admitted in PICU

documented by Iqbal H *et al.*[9] and Ramzan S *et al.* [10]. Limited access to healthcare, poor nutritional status, and delayed presentation in these populations contribute to the high disease burden and mortality associated with MODS in developing countries.

Sepsis (95.7%) and shock (69.1%) were the most common antecedents of MODS in our cohort. These findings are consistent with studies by Tantalean *et al.*[4] and Khilnani *et al.*[3], where sepsis was also the leading cause. Thukral *et al.*[11] similarly identified sepsis and respiratory distress as the top causes of PICU admissions. In our study, other contributing factors included hypoxemia (39.4%) and multiple transfusions (21.3%).

The clinical presentation of MODS was variable, with altered sensorium (50%), breathing difficulty (44.7%), and seizures (37.2%) being the most common symptoms. These findings mirror those of Giri *et al.* [1], who reported similar symptom frequencies in MODS cases. While fever is a common presenting symptom in many pediatric conditions, its lower incidence (12.8%) in our cohort may reflect a predominance of severe presentations overshadowing constitutional symptoms.

Neurological dysfunction was the most frequently affected organ system (50%), followed by respiratory (44.7%) and cardiovascular (39.4%) systems. These trends are comparable to the studies by Tantalean *et al.* [4] and Goh *et al.* [12], where the respiratory and neurological systems

Table:1 PELOD scoring

Mean PELOD score	*PELOD score (Mean ± SD)*
At the time of admission (n = 54)	11.03 ± 15.64
Maximum score during hospital stay (n = 94)	14.85 ± 16.75

Table 2: Comparison of PELOD score with primary outcome

PELOD score	*Outcome*		*p-valuea*
	Good (N = 61)	*Poor (N = 24)*	
On enrollment	6.45 ± 10.52 (2-61)	19.48 ± 19.35 (2-62)	0.0001
Maximum score	7.93 ± 11.16 (2-61)	27.29 ± 18.64 (2-63)	<0.0001

Table 3: Comparison of mean PELOD score values with mean duration of PICU stay (secondary outcome)

PELOD score values Mean +/- SD		*Mean duration of PICU stay (in days)*	*p-valuea*
On admission (n = 94)	11.03 ± 15.64	9.15 ± 6.50	0.416
Maximum PELOD score recorded during entire hospital stay (n = 94)	14.85 ± 16.75	9.15 ± 6.50	0.002

[a]Independent t-test

Table 4: Primary outcome (n = 94)

Outcome	*Frequency (n = 94)*	*Percentage (%)*
Good	61	64.9%
Poor	33	35.1%

were the most commonly involved. Dewi Metta *et al.*[7] also reported predominance of respiratory and cardiovascular dysfunctions.

Our blood culture positivity rate (34.4%) and predominant isolation of MRSA, *E. coli*, and *Acinetobacter baumannii* are consistent with the microbiological patterns reported by Khilnani *et al.* [3] and Goh *et al.* [12]. The high serum ferritin (median 1155.4 ng/mL), CRP, and transaminase levels in our study point toward the hyperinflammatory and hepatic involvement typical of MODS. These findings correspond with those from Lola Purnama Devi *et al.* [13], who associated elevated SGOT/SGPT and PT/INR with increased severity and mortality in dengue shock syndrome.

The mean PELOD score at admission was 11.03, and the maximum PELOD score recorded during PICU stay was 14.85. Our findings are in line with studies by Dewi Metta *et al.*[7] and Jyothirmanju *et al.*[14], which reported similar mean PELOD scores and validated its use as a reliable predictor of mortality in MODS. The PELOD

scoring system showed excellent discriminatory power, with significantly higher scores associated with both mortality and prolonged PICU stay ($p < 0.0001$ and $p = 0.002$, respectively). This supports earlier work by Lacroix *et al*.[15] and Thukral *et al*.,[11] who demonstrated the PELOD score's utility in monitoring disease progression and outcomes.

In our cohort, 35.1% of patients had a poor outcome, including a 25.5% mortality rate. This is comparable to the mortality reported by Giri *et al.* [1] (25.2%) and Tantalean *et al.*[4] (25.7%), and significantly higher than the 6.4% reported by Leteurtre *et al*.[16] in high-resource settings. The disparity in mortality reflects differences in infrastructure, early diagnosis, and access to advanced interventions such as ECMO or renal replacement therapy.

A striking finding in our study was the strong association between the number of organ dysfunctions and mortality. Patients with two organ failures had a mortality of 5.3%, while all patients with five or more organ dysfunctions died (p = 0.00001). Similar trends were observed by Ajay Gaur *et al.* [17] and Leclerc F *et al*.,[18] who reported mortality increasing from 10.3% with one organ failure to 100% with six organ failures.

We also found that the mean PELOD score was significantly higher in non-survivors (27.29 ± 18.64) than survivors (7.93 ± 11.16), again underscoring its utility as a prognostic tool. This trend was consistent with findings from Lacroix *et al.* [15], Hendra *et al.* [19], and Jyothirmanju *et al*.[14] The mean PICU stay was 9.15 days, with longer stays associated with survivors. This finding is supported by studies from George JP *et al*.[20] and Gaur *et al*.,[17] who noted that survivors often have longer stays, likely due to prolonged recovery and supportive care. Conversely, early mortality tends to shorten average PICU duration in non-survivors.

The PELOD score proved to be a valuable prognostic tool, with higher scores correlating with increased mortality. This finding supports its integration into routine clinical assessments to identify high-risk patients early and tailor management strategies accordingly.

Strengths and Limitations

This study contributes valuable data from a low-resource setting, offering insight into the burden and clinical behavior of MODS in such contexts. However, it is limited by its single-center design and modest sample size, which may restrict generalizability. Additionally, long-term outcomes such as neurological sequelae were not assessed.

CONCLUSION

The PELOD score is an effective tool for prognostication. Sepsis is the major etiology of MODS.[21] Higher PELOD scores are significantly associated with mortality.

REFERENCES

1. Giri A, Yadav SK, Sah V, Niroula N, Singh B. Multiple organ dysfunction syndrome—clinical profile, associations and outcome in critically ill children aged 1 month to 14 years admitted to PICU in Nobel Medical College Teaching Hospital in Biratnagar. Birat J Health Sci. 2019;4(1):629–33
2. Goldstein B, Giroir B, Randolph A. International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics. Pediatr Crit Care Med. 2005;6(1):2–8.
3. Khilnani P, Sarma D, Zimmerman J. Epidemiology and peculiarities of pediatric multiple organ dysfunction syndrome in New Delhi, India. Intensive Care Med. 2006;32:1856–62.
4. Tantaleán JA, León RJ, Santos AA, Sánchez E. Multiple organ dysfunction syndrome in children. Pediatr Crit Care Med. 2003;4(2):181–5.
5. Wilkinson JD, Pollack MM, Ruttimann UE, Glass NL, Yeh TS. Outcome of pediatric patients with multiple organ system failure. Crit Care Med. 1986;14(4):271–4.
6. Vikas P, Alka B, Nitesh M. To study the validity of pediatric logistic organ dysfunction (PELOD) score for predicting outcome among pediatric intensive care unit (PICU) patients. Int J Adv Res. 2019;5(1):69–72.
7. Metta D, Soebardja D, Hudaya D. The use of pediatric logistic organ dysfunction (PELOD) scoring system to determine the prognosis of patients in pediatric intensive care units. Paediatr Indones. 2006;46(1):1–6
8. Honna L, Triratna S, Triwani T, Theodorus T. Use of pediatric logistic organ dysfunction in determining prognosis among pediatric intensive care unit patients. Paediatr Indones. 2010;50(6):347–50.
9. Iqbal H, Khurshid A, Fayyaz A. Multiple organ dysfunction in children admitted at pediatric intensive care unit of the Children Hospital, Multan. Prof Med J. 2020;27(11):2345–9.
10. Ramzan S, Zaffar J, Mazhar S. Hyponatremia among critically ill children admitted to pediatric intensive care unit (PICU). J Med Physiol Biophys. 2017;37:35–9.
11. Thukral A, Saini SS, Gupta A, Lodha R, Kabra SK, Bagga A. Validation of the PELOD score for multiple organ dysfunction in children. Indian Pediatr. 2007;44(9):683–6.
12. Goh AY, Lum LC, Chan PW. Brief report: Paediatric intensive care in Kuala Lumpur, Malaysia: a developing subspecialty. J Trop Pediatr. 1999;45(6):362–4.
13. Dewi LP, Nurfitri E. Pediatric logistic organ dysfunction score as a predictive tool of dengue shock syndrome outcomes. Paediatr Indones. 2012;52(2):72–7.
14. Jyotirmanju CS, Karumbaiah P, Rau AT. Predicting mortality in pediatric intensive care unit using pediatric logistic organ dysfunction score in a tertiary care centre. Pediatr Oncall J. [year unknown];10(1):11–3.
15. Lacroix J, Cotting J. Severity of illness and organ dysfunction scoring in children. Pediatr Crit Care Med. 2005;6(3 Suppl):S126–34.
16. 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.
17. Gaur A, Ambey R, Sharma A. Modified pediatric logistic organ dysfunction scoring system: A feasible tool in pediatric

intensive care units. Int J Med Sci Res Pract. 2015;2(1):32–6.
18. Leclerc F, Leteurtre S, Duhamel A, Grandbastien B, Proulx F, Martinot A, *et al*. Cumulative influence of organ dysfunctions and septic state on mortality of critically ill children. Am J Respir Crit Care Med. 2005;171(4):348–53.
19. Hendra H, Runtunuwu AL, Manoppo JI. Pediatric logistic organ dysfunction (PELOD) score as prognosis of multiple organ failure in sepsis. Paediatr Indones. 2010;50(4):226–31.
20. George JP, Namboodiripad A. Evaluation of modified pediatric logistic organ dysfunction scoring system in predicting the outcome in critically ill children. Int J Contemp Pediatr. 2018;5(3):820–3.
21. Bryce J, Victora CG, Habicht JP, Vaughan JP, Black RE. The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions. Am J Public Health. 2004;94(3):406–15.