

A Study of Clinical Profile and Outcome of Shock in Children in Paediatric Intensive Care Unit in a Tertiary Care Hospital

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Abstract:

Background: Pediatric shock is a common and life-threatening emergency in intensive care units, with sepsis being a leading cause. Early recognition, risk stratification, and prompt management are crucial to improving outcomes. This study aimed to evaluate the clinical profile, laboratory parameters, and outcomes of children presenting with shock in a tertiary care pediatric intensive care unit (PICU) in India, with particular focus on the predictive utility of the PRISM III score.

Methods: A prospective observational study was conducted on 125 children admitted with shock. Demographic details, vital signs, laboratory parameters, etiology of shock, complications, need for inotropic support, and outcomes were recorded. PRISM III scores were calculated at admission to assess severity. Data were analyzed to identify factors associated with mortality.

Results: The majority of children were aged 1–5 years (44%) and male (63.2%), with most residing in urban areas (62.4%). Clinically, increased temperature (73.6%), tachycardia (70.4%), and tachypnea (74.4%) were common, with 55.2% hypotensive and 37.6% exhibiting oliguria. Septic shock was the predominant etiology (60%), followed by hypovolemic (15%), cardiogenic (15%), vasoplegic (14%), and obstructive shock (2%). Laboratory abnormalities included hyponatremia (16.8%), elevated CRP (60.8%), ferritin (43.2%), and deranged renal function (14.4%). Overall survival was 68%, with a mortality rate of 32%, higher among children with septic shock (70%). The mean \pm SD PRISM III score was significantly higher among non-survivors (28.15 ± 5.34) compared with survivors (11.48 ± 2.01), indicating its utility in severity assessment.

Conclusion: Pediatric sepsis in India is associated with high mortality, particularly in patients with multiorgan dysfunction, deranged laboratory parameters, and higher PRISM III scores. The PRISM III score is a useful tool for risk stratification and predicting length of hospital stay among survivors. Larger multicenter studies using updated sepsis definitions are warranted to better understand the burden and outcomes of pediatric sepsis in developing countries.

Keywords: Pediatric shock, Sepsis, PRISM III score, PICU, Mortality, Multiorgan dysfunction.

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Introduction

Shock is an acute condition characterized by the body's inability to deliver adequate oxygen and nutrients to meet the basal metabolic demands of vital organs and tissues, and is one of the most common pediatric emergencies, occurring in approximately 2% of hospitalized infants and children, particularly in developing countries [1]. In children, it is etiologically classified as hypovolemic shock due to reduced blood volume, cardiogenic shock due to abnormal cardiac function, distributive shock due to vasodilatation,

obstructive shock caused by any lesion producing a mechanical barrier that impedes cardiac output, and septic shock involving a complex interplay of distributive, hypovolemic, and cardiogenic mechanisms [1]. Without timely intervention, shock can progress to clinical deterioration, metabolic acidosis, and adverse vascular, inflammatory, metabolic, cellular, and endocrine effects culminating in multiple organ dysfunction syndrome (MODS), making early detection crucial as prompt management significantly reduces

morbidity and mortality; the outcome depends on the underlying cause and the timeliness of intervention [2,3]. Hence, this study was undertaken to estimate the incidence of shock in our tertiary care center and to determine the association of various clinical parameters with its outcome using the PRISM III score. To study the clinical profile and outcomes of children with shock admitted to the Non-COVID Pediatric Intensive Care Unit, and to assess the association between various clinical parameters and outcomes using the PRISM III score.

Materials and Methods

Study Design: This was a prospective observational cohort study.

Study Setting and Duration: The study was conducted in the Pediatric Intensive Care Unit (Non-COVID PICU) of the Department of Pediatrics, Calcutta National Medical College and Hospital, Kolkata, West Bengal, over approximately one year, from February 2021 to July 2022. Data collection was carried out from February 2021 to September 2021, and the study was completed by July 2022.

Study Population: Children aged 1 month to 12 years who developed shock either at admission or during their PICU stay were included.

Inclusion Criteria: All critically ill children aged 1 month to 12 years with shock on PICU admission or developing shock during PICU stay.

Exclusion Criteria

- Children with traumatic shock
- Children with post-cardiac arrest shock
- Children with post-surgical shock
- COVID-19 RT-PCR-positive cases

Sample Size: A total of 125 children were enrolled.

Ethical Considerations: Ethical clearance was obtained from the Institutional Ethics Committee.

Informed written consent was taken from the mother or guardian in English, Bengali, or Hindi, using simple language, after explaining the study process and follow-up schedule in their native tongue.

Study Parameters

A structured proforma was used to record the following:

- Patient profile: Name, age, sex
- History: Chief complaints, age at detection of shock, predisposing conditions
- Clinical examination: SBP, DBP, HR, RR, pupillary reactions
- Mental status: Glasgow Coma Scale
- Investigations: ABG analysis, serum bilirubin, aPTT/PT
- Treatment received: IV fluids (crystalloids/colloids), vasopressors, inotropes, oxygen therapy, NIV, mechanical ventilation
- Outcome: Survived or not survived

Study Techniques

1. Thorough history and clinical examination at presentation and follow-up
2. Documentation of routine and scheduled blood and radiological investigations
3. PRISM III score calculated within the first 24 hours of admission
4. Outcomes noted and compared according to type of shock and PRISM III score

Statistical Analysis: Data were analyzed using IBM SPSS Statistics 29 for Windows. Continuous variables were expressed as mean \pm standard deviation (SD) and analyzed using the independent-samples t-test. Categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

Results

Table 1: Distribution of demographic parameter

Variables	Category	Number of Children (n)	Percentage (%)
Age	<1 year	21	16.8
	1–5 years	55	44
	>5 years	49	39.2
Gender	Female	46	36.8
	Male	79	63.2
Residence	Urban	78	62.4
	Rural	47	37.6

Table 2: Association between Clinical Parameter: Group

Clinical Parameter	Discharge (n, %)	Death (n, %)	Total (n, %)
Temperature - Increased	60 (70.6%)	32 (80.0%)	92 (73.6%)
Temperature - Normal	25 (29.4%)	8 (20.0%)	33 (26.4%)
Heart Rate - Bradycardia	3 (3.5%)	2 (5.0%)	5 (4.0%)
Heart Rate - Normal	20 (23.5%)	12 (30.0%)	32 (25.6%)
Heart Rate - Tachycardia	62 (72.9%)	26 (65.0%)	88 (70.4%)
Respiratory Rate - Normal	21 (24.7%)	11 (27.5%)	32 (25.6%)
Respiratory Rate - Tachypnea	64 (75.3%)	29 (72.5%)	93 (74.4%)
Blood Pressure - Hypotension	48 (56.5%)	21 (52.5%)	69 (55.2%)
Blood Pressure - Normal	37 (43.5%)	19 (47.5%)	56 (44.8%)
Capillary Refill Time - Normal	33 (38.8%)	15 (37.5%)	48 (38.4%)
Capillary Refill Time - Prolonged	52 (61.2%)	25 (62.5%)	77 (61.6%)
Urine Output - Normal	55 (64.7%)	23 (57.5%)	78 (62.4%)
Urine Output - Oliguria	30 (35.3%)	17 (42.5%)	47 (37.6%)
GCS - Mild	58 (68.2%)	7 (17.5%)	65 (52.0%)
GCS - Moderate	25 (29.4%)	22 (55.0%)	47 (37.6%)
GCS - Severe	2 (2.4%)	11 (27.5%)	13 (10.4%)
Fluid Bolus - 1st	52 (61.2%)	17 (42.5%)	69 (55.2%)
Fluid Bolus - 2nd	33 (38.8%)	19 (47.5%)	52 (41.6%)
Fluid Bolus - 3rd	0 (0.0%)	4 (10.0%)	4 (3.2%)
SpO ₂ - Normal	60 (70.6%)	34 (85.0%)	94 (75.2%)
SpO ₂ - Hypoxic	25 (29.4%)	6 (15.0%)	31 (24.8%)

Table 3: Association between analysis of laboratory parameters: Group

Parameter	Category	Discharge n (%)	Death n (%)	Total n (%)
Hemoglobin (Hb %)	Decreased	5 (5.9)	15 (37.5)	20 (16.0)
	Normal	80 (94.1)	25 (62.5)	105 (84.0)
Total Leucocyte Count	Decreased	3 (3.5)	0 (0.0)	3 (2.4)
	Increased	51 (60.0)	25 (62.5)	76 (60.8)
	Normal	31 (36.5)	15 (37.5)	46 (36.8)
Blood Sugar	Normal	52 (61.2)	17 (42.5)	69 (55.2)
	Hypo	33 (38.8)	19 (47.5)	52 (41.6)
	Hyper	0 (0.0)	4 (10.0)	4 (3.2)
Renal Function (Creatinine)	Normal	80 (94.1)	27 (67.5)	107 (85.6)
	Elevated	5 (5.9)	13 (32.5)	18 (14.4)
Serum Sodium	Hyponatremia	8 (9.4)	13 (32.5)	21 (16.8)
	Hypernatremia	11 (12.9)	1 (2.5)	12 (9.6)
	Normal	66 (77.6)	26 (65.0)	92 (73.6)
Serum Potassium	Decreased	19 (22.4)	11 (27.5)	30 (24.0)
	Increased	6 (7.1)	8 (20.0)	14 (11.2)
	Normal	60 (70.6)	21 (52.5)	81 (64.8)
CRP	Increased	52 (61.2)	24 (60.0)	76 (60.8)
	Normal	33 (38.8)	16 (40.0)	49 (39.2)
ESR	Increased	49 (57.6)	15 (37.5)	64 (51.2)
	Normal	36 (42.4)	25 (62.5)	61 (48.8)
Serum Ferritin	Increased	40 (47.1)	14 (35.0)	54 (43.2)
	Normal	45 (52.9)	26 (65.0)	71 (56.8)
D-Dimer	Increased	8 (9.4)	0 (0.0)	8 (6.4)
	Normal	77 (90.6)	40 (100.0)	117 (93.6)
Serum Triglyceride	Increased	19 (22.4)	4 (10.0)	23 (18.4)
	Normal	66 (77.6)	36 (90.0)	102 (81.6)
Serum LDH	Increased	17 (20.0)	6 (15.0)	23 (18.4)
	Normal	68 (80.0)	34 (85.0)	102 (81.6)

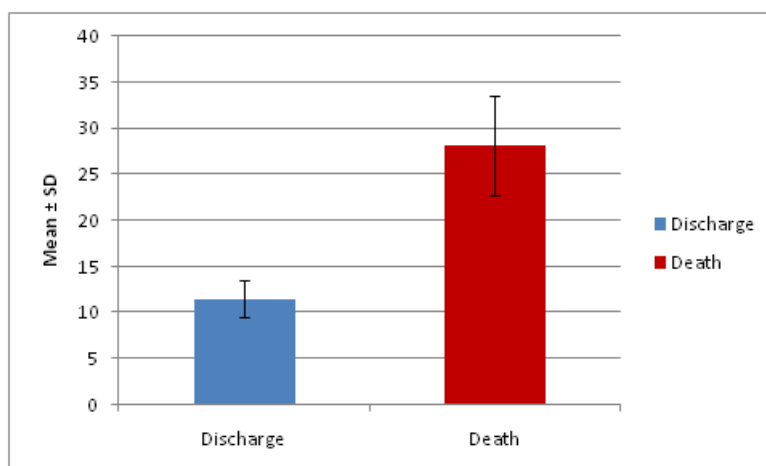


Figure 1: Distribution of Mean values of PRISM 3 among study subjects

In the present study, the majority of children were aged 1–5 years (44%), followed by those aged above 5 years (39.2%) and less than 1 year (16.8%). Males (63.2%) outnumbered females (36.8%). Most participants were from urban areas (62.4%), while 37.6% resided in rural regions. (Table 1)

Most patients had increased temperature (73.6%), tachycardia (70.4%), and tachypnea (74.4%). Hypotension occurred in 55.2%, and prolonged capillary refill in 61.6%. Oliguria was noted in 37.6%. GCS was mild in 52.0%, moderate in 37.6%, and severe in 10.4%, with severe cases more frequent among deaths. Most received the first fluid bolus (55.2%), fewer required the second (41.6%), and only 3.2% needed the third. Normal SpO₂ was seen in 75.2%, while hypoxia occurred in 24.8%, more common in deaths. (Table 2)

Among the study subjects, decreased hemoglobin was observed in 20 (16.0%) cases, more frequent in deaths (37.5%) than discharges (5.9%). Elevated total leukocyte count was seen in 76 (60.8%), normal in 46 (36.8%), and decreased in 3 (2.4%). Hypoglycemia occurred in 52 (41.6%), hyperglycemia in 4 (3.2%), and normal blood sugar in 69 (55.2%). Elevated creatinine was present in 18 (14.4%), hyponatremia in 21 (16.8%), and hypernatremia in 12 (9.6%). Abnormal potassium was noted in 44 (35.2%). Raised CRP was seen in 76 (60.8%), ESR in 64 (51.2%), ferritin in 54 (43.2%), D-dimer in 8 (6.4%), triglycerides in 23 (18.4%), and LDH in 23 (18.4%). (Table 3)

The mean ± SD PRISM III score among patients who were discharged was 11.48 ± 2.01, whereas among those who died it was 28.15 ± 5.34. (Figure 1)

Discussion

In the present study, the majority of children were aged 1–5 years (44%), followed by those above 5 years (39.2%) and less than 1 year (16.8%). Male

children predominated (63.2%), consistent with previous reports showing higher PICU admissions among males, possibly reflecting sociocultural factors in India [13,19]. Most participants were from urban areas (62.4%), while 37.6% resided in rural regions (Table 1).

Clinically, most patients presented with increased temperature (73.6%), tachycardia (70.4%), and tachypnea (74.4%). Hypotension occurred in 55.2%, prolonged capillary refill in 61.6%, and oliguria in 37.6%. GCS scores were mild in 52.0%, moderate in 37.6%, and severe in 10.4%, with severe impairment more frequent among deaths. Most children received a first fluid bolus (55.2%), fewer required a second (41.6%), and only 3.2% needed a third. Normal SpO₂ was observed in 75.2%, while hypoxia occurred in 24.8%, more common among non-survivors (Table 2). These findings are consistent with earlier studies on pediatric shock, which reported similar distributions of vital sign abnormalities and fluid resuscitation requirements [2,3,4]. Laboratory analysis revealed decreased hemoglobin in 20 (16.0%) patients, more frequent in deaths (37.5%) than survivors (5.9%). Elevated total leukocyte count was seen in 76 (60.8%), normal in 46 (36.8%), and decreased in 3 (2.4%). Hypoglycemia occurred in 52 (41.6%), hyperglycemia in 4 (3.2%), and normal blood sugar in 69 (55.2%). Elevated creatinine was present in 18 (14.4%), hyponatremia in 21 (16.8%), hypernatremia in 12 (9.6%), and abnormal potassium in 44 (35.2%). Inflammatory markers were raised in several patients: CRP in 76 (60.8%), ESR in 64 (51.2%), and ferritin in 54 (43.2%). D-dimer was elevated in 8 (6.4%), triglycerides in 23 (18.4%), and LDH in 23 (18.4%) (Table 3). Similar laboratory derangements in pediatric shock have been reported previously, highlighting hyponatremia, elevated inflammatory markers, and deranged renal function as common complications [8,9,19, 20]. The mean ± SD PRISM III score among survivors was 11.48 ±

2.01, whereas it was 28.15 ± 5.34 among non-survivors, indicating significantly higher severity scores in patients who died. This aligns with prior studies demonstrating higher PRISM scores in non-survivors, confirming its utility as a severity marker, though not always an independent predictor of mortality (Costa et al., 2011; Madaan et al., 2015; Gonçalves et al., 2010).

Septic shock was the predominant etiology (60%), followed by hypovolemic (15%), cardiogenic (15%), vasoplegic (14%), and obstructive shock (2%). Mortality was highest among children with septic shock, consistent with prior Indian and international reports [10, 13, 19]. Among children with septic shock, 70% died, whereas 51.8% survived, reflecting the rapidly progressive nature of sepsis in pediatric populations.

Conclusion

Sepsis among Indian children is associated with high mortality rates. Multiorgan dysfunction syndrome, elevated PRISM III scores, the need for multiple inotropes, and deranged hematological and biochemical parameters are significant predictors of poor outcome.

PRISM III scoring effectively differentiates between survivors and non-survivors and can also help predict length of hospital stay among survivors. However, larger multicenter prospective studies, aligned with updated sepsis definitions and clinical practice guidelines, are needed to accurately assess the burden and outcomes of pediatric sepsis in developing countries.

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