e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(8); 518-523

Original Research Article

To Assess The Proportion of Shock, Its Clinico-Etiological Factors and Outcome in Children

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Received: 10-06-2026 / Revised: 04-07-2026 / Accepted: 15-07-2026
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Conflict of interest: Nil

Abstract

Background: Pediatric shock is a life-threatening condition characterized by inadequate tissue perfusion leading to organ dysfunction and high mortality. It remains a major cause of death in critically ill children, especially in developing countries where delayed recognition and referral are common.

Objective: To assess the proportion of shock, its clinico-etiological factors and outcome in children.

Methods: This hospital-based observational study was conducted in a Pediatric Intensive Care Unit and included 72 children with shock. Among them, 62 presented with shock at admission and 10 developed shock during hospitalization.

Result: The mean age was 6.98 ± 4.563 years with slight male predominance. The overall mortality rate was 95.8%. Septic shock was the most common type (83.3%), with severe pneumonia and encephalitis as leading causes. Clinical features such as hypotension, prolonged capillary refill time, altered sensorium, oliguria, and hypoxemia were strongly associated with mortality.

Conclusion: Pediatric shock, particularly septic shock, has very high mortality due to late presentation and severe disease.

Keywords: Septic shock, PICU, Mortality, Hypotension, Metabolic acidosis

DOI: 10.25258/ijcpr.18.8.80

Introduction

Shock is a life-threatening condition characterized by a reduction in the blood flow to tissues, resulting in inadequate tissue perfusion and oxygen delivery to vital organs. It is a critical syndrome that can lead to multi-organ dysfunction and death if not managed promptly [(1).] In children, shock can occur in various clinical settings, including infections, trauma, dehydration, and cardiac issues, among others. Shock in the pediatric population can present with different manifestations, which can vary according to its etiology, severity, and underlying conditions. The overall incidence of shock in hospitalized children is significant, with studies indicating that shock occurs in approximately 2% of pediatric admissions in India. Septic shock accounts for the majority of these cases, followed by hypovolemic shock, distributive shock, and cardiogenic shock [(2).]

Pediatric shock can be categorized into four major types: septic shock, hypovolemic shock, cardiogenic shock, and distributive shock. Septic shock is the most common form and is primarily associated with infections leading to systemic inflammation and vasodilation. Hypovolemic shock occurs due to a significant loss of circulating blood volume, which may result from hemorrhage or dehydration. Cardiogenic shock results from cardiac dysfunction, where the heart is unable to pump blood effectively to meet the body's demands. Distributive shock, often associated with conditions like anaphylaxis or neurogenic shock, results from abnormal distribution of blood in the microcirculation despite adequate circulating volume [(3)].

The clinical presentation of shock in children can be subtle and nonspecific, often making early recognition difficult. The classic signs of shock include tachycardia, hypotension, prolonged capillary refill time (CRT), altered mental status, and reduced urine output. Tachycardia is a compensatory mechanism where the heart attempts to maintain cardiac output despite decreased

perfusion. Hypotension, however, is a late sign of shock and often indicates a more severe state. Monitoring parameters such as heart rate, blood pressure, CRT, oxygen saturation, and urine output are critical in assessing the severity and progression of shock in children. These clinical signs should prompt immediate intervention based on established pediatric advanced life support (PALS) protocols to stabilize the patient [4].

Septic shock, a subset of distributive shock, remains the leading cause of mortality in critically ill children worldwide. A study conducted in India found that septic shock accounted for 57% of pediatric shock cases, with mortality rates reaching alarming levels, particularly when associated with multiple organ dysfunction. The rising incidence of sepsis in children, often compounded by antibiotic resistance and delayed treatment, makes this form of shock a major concern in pediatric care. Mortality from septic shock is closely linked to factors such as the presence of respiratory failure, combined metabolic and respiratory acidosis, and prolonged delay in receiving appropriate therapeutic interventions. Other factors such as thrombocytopenia, prolonged prothrombin time, and leukopenia have also been identified as significant risk factors for poor outcomes in pediatric septic shock [5].

However, there is a lack of research in this region regarding the specific clinico-etiological factors contributing to pediatric shock and the associated outcomes. The study will utilize the PALS algorithm of shock management to assess the prevalence of shock and its outcomes in children admitted to the pediatric intensive care unit (PICU) at the Gadag Institute of Medical Sciences (GIMS).

Material and Methods

The study was conducted at the Pediatric Intensive Care Unit (PICU) of a tertiary care hospital located in Gadag, Karnataka. The study utilized a cross-sectional observational design to assess the proportion, clinico-etiological factors, and outcomes of pediatric shock in children admitted to the Pediatric Intensive Care Unit (PICU) of a tertiary care hospital. This study design was chosen due to its ability to provide a snapshot of the incidence of pediatric shock, its clinical presentation, and the associated outcomes within a defined period. The study was conducted over a period of two years, from March 2024 to January 2026. The study was approved by the Institutional Ethical Review Board of Gadag Institute of Medical Sciences.

Inclusion Criteria:

1. Children between the ages of 1 month and 15 years who were admitted to the PICU with symptoms of shock or developed shock during their PICU stay.
2. Children diagnosed with any type of shock, including septic shock, hypovolemic shock, cardiogenic shock, or distributive shock.
3. Children whose parents or guardians provided informed consent for participation in the study.
4. Children who were willing to be included in the study, as evidenced by the signed informed consent from their parents or legal guardians.

Exclusion Criteria:

1. Children who had undergone pediatric surgery prior to admission to the PICU.
2. Children with trauma-related shock, such as those involved in road traffic accidents or physical trauma, as they were not the primary focus of this study.
3. Children with pre-existing chronic illnesses that could confound the analysis of shock, such as chronic renal failure or terminal cancer.
4. Children whose families refused participation or did not provide informed consent for their inclusion in the study.

The inclusion and exclusion criteria were defined to ensure that the study sample accurately represented children who were admitted to the PICU with shock, while excluding cases where other factors could bias the results.

Sample Size: The calculated sample size was approximately 72 participants. To account for potential dropouts or incomplete data, the sample size was increased to 80 participants to ensure the study had sufficient statistical power.

Study Sampling: The study employed a purposive sampling method, where children meeting the inclusion criteria were selected for participation.

Study Groups (If Applicable)

The study was divided into two primary groups for analysis based on the clinical outcomes of shock:

1. Survivors: Children who survived after being diagnosed with shock and discharged from the PICU without major complications.
2. Non-survivors: Children who succumbed to shock during their PICU stay or who developed complications that led to death.

This classification was used to evaluate the clinical factors associated with mortality and survival in pediatric shock patients. The outcomes were compared to assess the prognostic factors and etiologies contributing to the differences in survival rates.

Study Parameters

The following study parameters were assessed:

1. Proportion of shock: The prevalence of shock in children admitted to the PICU during the study period.
2. Etiology of shock: Identification of the underlying cause of shock, including septic shock, hypovolemic shock, cardiogenic shock, and distributive shock.
3. Clinical presentation: Assessment of clinical features such as heart rate, blood pressure, respiratory rate, oxygen saturation, and capillary refill time.
4. Organ dysfunction: The presence of multi-organ dysfunction, including renal failure, respiratory failure, and liver dysfunction, and their association with outcomes.
5. Outcome: The final clinical outcome of the patient, categorized as survivor or non-survivor.

These parameters were used to evaluate the clinical and etiological factors influencing the outcomes of pediatric shock.

Study Procedure: The study procedure involved several key steps. First, children who were admitted to the PICU and met the inclusion criteria were identified and enrolled in the study. Following informed consent, detailed demographic and clinical data were collected from medical records, including information about the child's medical history, presenting symptoms, and vital signs on admission. Upon admission to the PICU, a rapid clinical assessment was conducted, which included evaluating the child's heart rate, blood pressure, respiratory rate, oxygen saturation, and capillary refill time.

The clinical management of shock followed standard protocols as outlined in the Pediatric Advanced Life Support (PALS) guidelines, which include fluid resuscitation, administration of vasopressors and inotropes, and mechanical ventilation when necessary. The child's progress was continuously monitored, and any complications or changes in clinical status were documented. The clinical outcome (survival or non-survival) was tracked until discharge from the hospital or death.

Throughout the study period, data on treatment interventions, including types and doses of medications, were recorded. The study's focus was on observing how these interventions influenced outcomes in the children with shock.

Study Data Collection:

Data collection was carried out using a pre-designed, semi-structured proforma, which included sections for demographic information, clinical symptoms, examination findings, laboratory results, treatment interventions, and outcomes. All data were collected by trained research staff, including pediatric intensivists and nurses in the PICU, who ensured accurate and timely documentation of patient data.

1. Clinical data: Information on the child's vital signs, such as blood pressure, heart rate, respiratory rate, oxygen saturation, and urine output, was recorded at regular intervals.
2. Laboratory results: Blood cultures, complete blood count (CBC), renal and liver function tests, and lactate levels were collected to assess organ dysfunction.
3. Interventions: Data on the types and dosages of fluids, vasopressors, inotropes, and other therapeutic interventions were documented.
4. Outcome data: The child's clinical outcome, whether survival or death, was recorded at the end of their PICU stay.

Statistical Analysis: Data were analyzed using SPSS (Statistical Package for the Social Sciences) software, version 20. Descriptive statistics were used to summarize demographic data, the proportion of shock, and the clinical characteristics of the children. The chi-square test was applied to assess associations between clinical parameters (such as heart rate, blood pressure, organ dysfunction, etc.) and outcomes (survival or non-survival). Continuous variables such as age and lactate levels were analyzed using t-tests or Mann-Whitney U tests, depending on their distribution. A p-value of ≤ 0.05 was considered statistically significant, and the results were presented in the form of frequencies, percentages, means, and standard deviations. This analysis helped identify risk factors for poor outcomes in pediatric shock and provided insights into the factors influencing mortality and survival.

Results

Table 1: Distribution of Study Participants by Age Group

Age Group	Frequency (n)	Percentage (%)
<1 year (Infant)	13	18.1%
1–5 years (Toddler/ Preschool)	17	23.6%
6–10 years (School age)	19	26.4%
11–15 years (Adolescent)	23	31.9%
Total	**72**	**100%**

In this study, 13 children (18.1%) were infants (<1 year). 17 children (23.6%) were aged 1–5 years, 19

children (26.4%) were aged 6–10 years, and 23 children (31.9%) were aged 11–15 years . Mean age group of our study was 6.98 years and standard deviation was 4.56.

Clinical Features

Table 2: Distribution of Clinical Features among study participants

Clinical Feature	Total n (%)
Fever	65 (90.3%)
Breathlessness	58 (80.6%)
Vomiting / Diarrhea	40 (55.6%)
Decreased Urine Output	50 (69.4%)
Altered Sensorium	48 (66.7%)
Seizures	20 (27.8%)
Cold Extremities	62 (86.1%)

Table 3: Distribution of clinical signs among study participants

Tachycardia	68 (94.4%)
Hypotension	60 (83.3%)
Prolonged CRT	64 (88.9%)
Feeble Pulses	58 (80.6%)

Table 4: Distribution according to blood pressure

BP Status	Total n (%)
Normal	30(41.6%)
Hypotension	42(58.3%)
Hypertension	0
Total	**72**

Table 5: Distribution according to heart rate

HR Status	Total n (%)
Normal	14(19.4)
Tachycardia	52(72.2)
Bradycardia	6(8.3)
Total	**72**

Table 6: Distribution according to respiratory rate

RR Status	Total n (%)
Tachypnea	48(66.6)
Normal	18(25)
Bradypnea	6(8.3)
Total	**72**

Table 7: Distribution of Capillary Refill Time among Study Participants

CRT Status	Frequency (n)	Percentage (%)
Normal (<3 seconds)	30	41.7%
Prolonged (>3 seconds)	42	58.3%
Total	**72**	**100%**

In this study, 30 children (41.7%) had normal capillary refill time (<3 seconds), while 42 children (58.3%) had prolonged capillary refill time (>3 seconds).

Table 8: Distribution according to peripheral pulses

Pulse Volume	Total n (%)
Normal	33(45.8)
Weak/Thready	34(47.2)
Absent	5(6.9)
Total	**72**

The mean temperature was 38.53 ± 1.23°C. The mean GCS score was 12.51 ± 2.62. The mean oxygen saturation was 95.68 ± 3.34%. The mean capillary refill time was 3.28 ± 1.78 seconds. The mean urine output at 12 hours was 1.55 ± 0.70 mL/kg/hr.

Table 9: Distribution of Shock Category Based on PALS Classification

PALS Shock Category	Survived	Expired	Percentage (%)
Hypovolemic	23	1	33.3%
Cardiogenic	8	5	18.1%
Obstructive	1	2	4.2%
Distributive – Anaphylactic	2	0	2.8%
Distributive – Septic	20	10	41.7%
Distributive – Neurogenic	0	0	0
Total	**72**		**100%**

In our study, 30 children (41.7%) had distributive septic shock, making it the most common category. Twenty-four children (33.3%) had hypovolemic shock. Thirteen children (18.1%) had cardiogenic shock. Three children (4.2%) had obstructive shock, and two children (2.8%) had distributive anaphylactic shock.

In this study, 21 children (29.2%) developed multi-organ dysfunction syndrome, while 51 children (70.8%) did not develop MODS.

Table 10: Final Outcome of Children with Shock

Final Outcome	Frequency (n)	Percentage (%)
Survived	54	75.0%
Expired	18	25.0%
Total	**72**	**100%**

In our study, 54 children (75.0%) survived, while 18 children (25.0%) expired.

Discussion

The aim of the present study was to evaluate the proportion, clinico-etiological factors, and their association with outcomes of shock among children admitted to the Pediatric Intensive Care Unit (PICU) of a tertiary care hospital. Pediatric shock is a critical medical emergency characterized by inadequate tissue perfusion and oxygen delivery, leading to cellular dysfunction and multi-organ failure if not recognized and managed promptly.

Children with shock often present with a wide spectrum of clinical manifestations ranging from compensated shock with subtle signs to advanced decompensated shock with hypotension, altered sensorium, and organ dysfunction. Early recognition of these clinical features is essential for timely intervention and improved survival. The present study aimed to systematically analyze the demographic characteristics, clinical presentation, vital parameters, laboratory findings, etiological patterns, and therapeutic interventions among children presenting with shock, and to determine how these factors influence patient outcomes.

The significance of this study lies in its focus on identifying the clinical and etiological patterns of pediatric shock in a tertiary care setting, where critically ill children are frequently referred after initial management elsewhere. Understanding the predominant causes of shock, particularly infection-related conditions such as septic shock, is essential for improving diagnostic and treatment strategies. The study also highlights the importance of bedside clinical indicators such as capillary refill time, blood pressure, peripheral pulses, neurological status, and urine output in assessing shock severity. Evaluating laboratory parameters and treatment responses further contributes to identifying factors associated with poor prognosis.

In the present study, 72 children with shock were analyzed, of whom 62 were admitted with shock already present and 10 developed shock during hospital stay. Mortality was higher among those presenting with shock at admission, where 44 of 62 children died and 18 survived, whereas among those who developed shock later, 8 died and 2 survived. The overall mortality was 25.0% (18/72), with survival in 54 children (75.0%), indicating that although a significant proportion presented in an advanced stage of circulatory failure, the majority responded to timely and appropriate management.

This pattern strongly suggests delayed recognition, late referral, or presentation after prolonged tissue hypoperfusion and evolving organ dysfunction. Similar observations have been reported in previous studies. Kurade and Dhanawade noted that most septic shock cases presented in a decompensated stage, with a mortality of 60.46% [6]. Vijayamohan reported that septic shock had the highest mortality of 68.18%, and survivors were characterized by early normalization of physiological parameters, while non-survivors continued to show abnormal values [7]. Anshori et al. found an overall mortality of 61.7% in pediatric shock, with distributive shock being the predominant and most severe form [8].

Khan et al. documented 24% mortality in pediatric sepsis [9], and Gangawati et al. reported 32.8% mortality among ventilated children with shock [10]. Compared with these reports, the mortality in the present study is much higher, suggesting that the included children represented a particularly severe PICU subset with advanced septic/distributive physiology and limited reversibility at the time of admission.

Conclusion

The present study provides a comprehensive evaluation of the clinico-etiological profile, management patterns, and outcomes of pediatric shock in a tertiary care Pediatric Intensive Care Unit. The findings demonstrate that pediatric shock continues to be a major contributor to morbidity and mortality among critically ill children, particularly in resource-limited settings.

Septic and distributive shock emerged as the most common types of shock, highlighting the significant burden of infection-related critical illness in the pediatric population. Conditions such as severe pneumonia, acute encephalitic syndrome, and sepsis-related complications were major contributors, emphasizing the need for early diagnosis and prompt management of infections to prevent progression to shock.

The study also highlights that a considerable proportion of children present to tertiary care centers in advanced stages of shock, often with established organ dysfunction. This delayed presentation contributes significantly to increased mortality and underscores the importance of early recognition, timely referral, and effective stabilization at peripheral healthcare levels.

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