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Original Research Article

Clinical patterns, management and outcomes of shock in children: a five-year review from a tertiary hospital in South-South Nigeria

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ABSTRACT

Background: Shock is a life-threatening paediatric emergency marked by inadequate tissue perfusion and rapid progression to organ failure if untreated. Mortality remains high in low- and middle-income countries, where delayed recognition and limited resources hinder optimal care. Septic and hypovolaemic shock predominate in sub-Saharan Africa, often driven by infectious diseases and malnutrition. Understanding local patterns is essential for improving early detection and treatment. Therefore, the study aimed to describe the clinical features, management practices and factors associated with mortality among children admitted with shock to the Children's Emergency Ward of Federal Medical Centre, Yenagoa.

Methods: A retrospective review of children admitted with shock between January 2018 and December 2022 was conducted. Case notes were examined for demographic data, presenting features, laboratory findings, type of shock, interventions and outcomes. Data were analysed using SPSS version 26. Associations were assessed using Chi-square or Fisher's exact test.

Results: Fifty-four cases were identified among 4,453 admissions. Septic shock was the most common type. Severe malnutrition, hypoglycaemia, anaemia, electrolyte derangements, leukocytosis and low oxygen saturation were significantly associated with mortality. Use of intraosseous access and inotropes was linked with poor outcomes, while fluid-only resuscitation had the best survival. All deaths occurred within 48 hours.

Conclusions: Septic shock remains the dominant and most fatal form of paediatric shock in this setting. Early recognition, prompt resuscitation and strengthened emergency care systems are critical to improving outcomes.

Keywords: Clinical outcomes, Emergency care, Fluid resuscitation, Paediatric shock, Septic shock

INTRODUCTION

Shock is a critical paediatric emergency that results from the failure of the circulatory system to deliver adequate oxygen to tissues, leading to cellular dysfunction, organ failure and, if untreated, death.[1] Children deteriorate more rapidly than adults because they compensate with increased heart rate and peripheral vasoconstriction for as long as possible, once these mechanisms fail, decompensation is swift and often irreversible.[1] Early recognition and timely intervention therefore remain central to survival.[1] Globally, paediatric shock continues to account for a significant proportion of childhood mortality. Severe sepsis and septic shock the most common forms have reported case-fatality rates ranging from 10% to over 50%, with mortality highest in low- and middle-income countries where delays in recognition and limited critical-care resources are prevalent.[2] A systematic review focusing on LMICs found mortality rates between 34% and 59% depending on the underlying cause and hospital capacity.[3] In sub-Saharan Africa, studies show that shock contributes between 2% and 10% of paediatric emergency presentations, with mortality frequently exceeding 20–30%.[4–7] Septic and hypovolaemic shock dominate, reflecting the region's burden of infectious diseases, diarrhoeal illness, malaria

and malnutrition. These patterns are similar to reports from India and other LMICs, where septic shock remains the leading cause, followed by hypovolaemic and cardiogenic shock.[8,9] In Nigeria, shock remains a major contributor to paediatric emergency deaths. Studies from Southern Nigeria indicate that circulatory failure accounts for 8-15% of emergency presentations, often complicated by late referral, inadequate pre-hospital care and coexisting morbidities such as sepsis, severe malaria and severe anaemia.[10,11] Clinical predictors of poor outcome include altered mental status, prolonged capillary refill time, hypotension and multiorgan involvement. Similar findings have been reported in large emergency department studies worldwide, reaffirming the universal challenge of identifying shock early enough to prevent progression.[12]

Management of shock in children requires rapid triage, immediate airway and breathing support, timely fluid resuscitation, early antibiotics for septic shock and vasoactive support when indicated. These steps are emphasized in global emergency care guidelines, including the WHO Emergency Triage, Assessment and Treatment (ETAT) protocol, which aims to improve outcomes through structured, early recognition and intervention (WHO, 2016).[13] However, implementation in resource-limited settings remains inconsistent due to shortages of monitoring equipment, inotropes, laboratory support and trained personnel.

Federal Medical Centre, Yenagoa, serves as the major referral centre for Bayelsa State and neighboring communities. As the primary site for paediatric emergencies in the region, it receives children with a wide range of life-threatening conditions, including various forms of shock. Understanding how shock presents in this setting, the treatments commonly administered and the associated outcomes is essential for guiding clinical practice, improving emergency readiness and informing policy. This study therefore seeks to describe the presentation, management practices and outcomes of shock among children treated at a tertiary health facility in South-South Nigeria, with the aim of identifying gaps and opportunities for strengthening paediatric emergency care in the region.

METHODS

Study design and setting

This was a retrospective, cross-sectional, hospital-based study conducted in the Children Emergency Ward (CHEW) of the Federal Medical Centre, Yenagoa, Bayelsa State. FMC Yenagoa is a 425 beds tertiary referral hospital that provides specialist healthcare services to the population of Bayelsa State and neighboring regions.[14] The CHEW is equipped with 10 beds open ward, a procedure room, an intensive care room, a triage area and a side laboratory. The ward is manned by a multidisciplinary team comprising pediatric nurses, house officers, resident doctors and consultant pediatricians. It operates a 24 hours service.

Study population

The study population comprised all children admitted to the CHEW with a diagnosis of shock between January 2018 and December 2023.

Data collection

Cases of pediatric shock were identified from the CHEW admission and discharge registers. Medical records of these patients were retrieved from the hospital records department. Data were extracted using a structured proforma that captured key clinical and demographic information relevant to each case. This included sociodemographic details such as age, gender and socioeconomic status. Presenting symptoms recorded encompassed common features associated with pediatric shock, including fever, vomiting, diarrhoea and respiratory distress.

Anthropometric measurements like weight and height were taken and documented. In addition, relevant laboratory investigations were obtained, including random blood sugar levels, full blood count, serum electrolytes and creatinine concentrations. The proforma also recorded the type of shock diagnosed (such as septic or hypovolaemic) as well as the suspected underlying cause.

Management strategies instituted during the course of admission were detailed, including whether the patient received intravenous fluids, inotropes or blood transfusions. Finally, patient outcomes were noted, specifically whether the child was discharged alive or died during hospitalization. Socioeconomic classification was done using the revised scoring system by Ibadin and Akpede.[15]

Data analysis

Data were analyzed using IBM SPSS Statistics version 26. Continuous variables were summarized using means and standard deviations or medians and interquartile ranges, depending on distribution. Categorical variables were summarized using frequencies and percentages. Chi-square or Fisher's exact test was used to assess associations between categorical variables. Statistical significance was set at $p<0.05$.

Ethical consideration

Ethical approval was obtained from the Research and Ethics Committee of the Federal Medical Centre, Yenagoa. Permission was also sought from the nurses in charge of the children emergency ward. All data were anonymized and patient confidentiality was maintained throughout the study.

RESULTS

During the five-year review period, a total of 4,453 children were admitted into the CHEW. Of these, 62 were admitted for childhood poisoning, accounting for approximately 1.4% of all admissions. However, only 54 cases were included in the final analysis, as eight case notes were unavailable for review.

Demographic characteristics

Most of the children were under one year of age 24 (44.5%) and the majority were male 32 (59.3%), with a male-to-female ratio of 1.5:1. A significant proportion 45 (83.3%) lived in urban areas. Over half of the mothers had at least primary education, while one-fifth had no formal education. More than half 30 (55.6%) of the households belonged to the lower socioeconomic class (Table 1).

Presenting complain and clinical features of subjects

Fever was the most common symptom (92.6%), followed by vomiting (81.5%) and loss of consciousness (74.1%). Convulsions and diarrhoea were also frequent, occurring in 70.4% and 64.8% respectively. Most children (70.4%) had normal nutritional status, while 27.8%. Nearly half (48.2%) of the children presented with low oxygen saturation (Table 2).

Laboratory findings of subjects

Most of the children (74.1%) had normal blood sugar levels. Low blood sugar was seen in 20.4% of the subjects, while 5.5% had elevated levels. Electrolyte derangement was recorded in 27.8% of the cases. Anaemia was present in 75.9% of the children and leukocytosis was observed in 53.7% (Table 3).

Type of shock, accompanying diagnosis, resuscitation methods and outcome

Septic shock was more prevalent than hypovolaemic shock (59.3% vs. 40.7%). Acute diarrhoeal disease (68.5%) was the leading accompanying diagnosis, with pneumonia and meningitis also commonly reported. Most children were resuscitated with fluids only (46.3%) or a combination of fluids, inotropes and blood (38.9%), with dopamine as the sole inotrope used. Intraosseous access was employed in about a quarter of the cases. The average hospital stay was about 73 hours and over half stayed beyond 48 hours. The overall mortality rate was high at 51.8% (Table 4).

Association between sociodemographic characteristics and outcome of subjects

Mortality was significantly higher among children whose mothers had no formal education (81.8%) compared to those with tertiary education (35.7%) ($p=0.037$). Similarly, children from lower socioeconomic backgrounds had the highest mortality rate (66.7%), while those from upper class had the lowest (12.5%) ($p=0.018$). No significant associations were found between outcome and age, gender or place of residence (Table 5).

Association between clinical presenting features and outcome

Delayed presentation was significantly linked to poorer outcomes, with children who died presenting after an average of 5.71±2.09 days, compared to 2.77±1.31 days among survivors ($p<0.001$). Nutritional status also showed a significant association with mortality ($p=0.006$), all children with severe malnutrition died, while those with normal nutrition had better survival rates. Fever was associated with increased mortality ($p=0.031$), as all children without fever survived, whereas 56.0% of febrile children died (Table 6). Loss of consciousness had a strong association with death ($p<0.001$), 92.9% of children who presented with this symptom died. Convulsions were similarly associated with higher mortality ($p=0.001$), with 87.5% of affected children dying. Both cough and tachypnea were significantly linked to poor outcomes ($p<0.001$), with death rates of 85.0% and 86.2%, respectively. Low oxygen saturation was a critical predictor of death ($p<0.001$), as 92.3% of children with low saturation died compared to just 14.3% with normal saturation. Vomiting and diarrhea did not show significant associations with outcome (Table 6).

Association between laboratory findings and outcome

Low blood sugar was strongly associated with mortality, as all children with hypoglycemia died, while 62.5% of those with normal glucose levels survived ($p=0.001$). Electrolyte abnormalities were also significantly linked to poor outcomes, with a 93.3% death rate compared to 35.9% in children without such derangements ($p<0.001$). Anaemia was another critical factor, as 92.3% of anaemic children died, whereas 61.0% of non-anaemic children survived ($p=0.001$). Additionally, leukocytosis was associated with a high mortality rate of 82.8%, while only 16.0% of those without leukocytosis died ($p<0.001$) (Table 7).

Association between type of shock, accompanying diagnosis, resuscitation methods and outcome

Septic shock was significantly associated with mortality, with 84.4% of affected children dying, compared to just 4.5% among those with hypovolaemic shock ($p<0.001$). Pneumonia and meningitis also showed high mortality rates of 90.0% and 86.7%, respectively ($p<0.001$ and $p=0.001$). All children who required intraosseous access died, whereas 65.0% of those with peripheral venous access survived ($p<0.001$). Fluid-only resuscitation was associated with the best outcomes, with a 96.0% survival

rate, while all children who received fluid plus blood alone died. Use of inotropes with or without blood was linked to over 80% mortality (p<0.001). Additionally, all deaths occurred within the first 48 hours of admission, while children who stayed beyond 48 hours had an 83.9% survival rate (p<0.001) (Table 8).

Table 1: Socio-demographic characteristics of subjects.

Variable	Frequency	%
Age category		
<1 year	24	44.5
1-<5 years	20	37.0
>5 years	10	18.5
Gender		
Male	32	59.3
Female	22	40.7
Place of residence		
Urban	45	83.3
Rural	9	16.7
Mothers level of education		
No formal education	11	20.4
Primary	16	29.6
Secondary	13	24.1
Tertiary	14	25.9
Socioeconomic status		
Lower	30	55.6
Middle	16	29.6
Upper	8	14.8

Table 2: Presenting complain and clinical features of subjects.

Variable	Frequency	%
Fever	50	92.6
Vomiting	44	81.5
Loss of consciousness	40	74.1
Convulsion	38	70.4
Diarrhea	35	64.8
Cough	34	63.0
Tachypnea	29	53.7
Nutritional status		
Severe	9	16.7
Moderate	6	11.1
Normal	38	70.4
Overweight/Obese	1	1.8
Oxygen saturation		
Normal	28	51.8
Low	26	48.2

Table 3: Laboratory findings of subjects.

Variable	Frequency	%
Blood sugar		
Low	11	20.4
Normal	40	74.1
High	3	5.5
Electrolyte derangement		
Yes	15	27.8
No	39	72.2
Anaemia		
Yes	41	75.9
No	13	24.1

Continued.

Variable	Frequency	%
Leukocytosis		
Yes	29	53.7
No	25	46.3

Table 4: Type of shock, accompanying diagnosis, resuscitation methods and outcome.

Variable	Frequency	%
Type of shock		
Septic	32	59.3
Hypovolaemic	22	40.7
Accompanying diagnosis		
Acute diarrhoeal disease	37	68.5
Pneumonia	20	37.0
Meningitis	15	27.8
Severe malaria	8	14.8
Intussusception	1	1.8
Ruptured viscus	1	1.8
Venous access		
Peripheral	40	74.1
Intraosseous	14	25.9
Resuscitation		
Fluid only	25	46.3
Fluid plus inotropes plus blood	21	38.9
Fluid plus inotropes	6	11.1
Fluid plus blood	2	3.7
Duration of stay		
Mean 72.98±76.13		
<24 hours	18	33.3
24-48 hours	5	9.3
>48 hours	31	57.4
Outcome		
Died	28	51.8
Survived	26	48.2

Table 5: Association between sociodemographic characteristics and outcome of subjects.

Variable	Survived	Died	Statistics	P value
Age category (in years)				
<1	10 (41.7)	14 (58,3)	5.00	0.082
1-<5	8 (40.0)	12 (60.0)		
>5	8 ((80.0)	2 (20.0)		
Gender				
Male	15 (46.9)	17 (53.1)	0.05	0.821
Female	11 (50.0)	11 (50.0)		
Place of residence				
Urban	23 (51.1)	22 (48.9)	0.95	0.330
Rural	3 (33.3)	6 (66.7)		
Mothers level of education				
No formal education	2 (18.2)	9 (81.8)	8.46	0.037
Primary	6 (37.5)	10 (62.5)		
Secondary	9 (69.2)	4 (30.8)		
Tertiary	9 (64.3)	5 (35.7)		
Socioeconomic status				
Lower	10 (33.3)	20 (66.7)	8.02	0.018
Middle	9 (56.2)	7 (43.8)		
Upper	7 (87.5)	1 (12.5)		

Table 6: Association between clinical presenting features and outcome.

Variable	Survived	Died	Statistics	P value
Duration before presentation	2.77±1.31	5.71±2.09	-6.26	<0.001
Nutritional status				
Severe	0 (0.0)	9 (100.0)		
Moderate	2 (33.3)	4 (66.7)	12.29	0.006
Normal	23 (60.5)	15 (39.5)		
Overweight/Obese	1 (100.0)	0 (0.0)		
Fever				
Yes	22 (44.0)	28 (56.0)	4.65	0.031
No	4 (100.0)	0 (0.0)		
Vomiting				
Yes	23 (52.3	21 (47.3)	1.62	0.203
No	3 (30.0)	7 (70.0)		
Loss of consciousness				
Yes	1 (7.1)	13 (92.9)	12.73	<0.001
No	25 (62.5)	15 (37.5)		
Convulsion				
Yes	2 (12.5)	14 (87.5)	11.57	0.001
No	24 (63.2)	14 (36.8)		
Diarrhea				
Yes	20 (57.1)	15 (42.9)	3.22	0.073
No	6 (31.6)	13 (68.4)		
Cough				
Yes	3 (15.0)	17 (85.0)	13.98	<0.001
No	23 (67.7)	11 (32.3)		
Tachypnea				
Yes	4 (13.8)	25 (86.2)	29.61	<0.001
No	22 (88.0)	3 (12.0)		
Oxygen saturation				
Normal	24 (85.7)	4 (14.3)	32.87	<0.001
Low	2 (7.7)	24 (92.3)		

Table 7: Association between laboratory findings and outcome.

Variable	Survived	Died	Statistics	P value
Blood sugar				
Low	0 (0.0)	11 (100.0)	13.78	0.001
Normal	25 (62.5)	15 (37.5)		
High	1 (33.3)	2 (66.7)		
Electrolyte derangement				
Yes	1 (6.7)	14 (93.3)	14.31	<0.001
No	25 (64.1)	14 (35.9)		
Anaemia				
Yes	1 (7.7)	12 (92.3)	11.22	0.001
No	25 (61.0)	16 (39.0)		
Leukocytosis				
Yes	5 (17.2)	24 (82.8)	23.97	<0.001
No	21 (84.0)	4 (16.0)		

Table 8: Association between type of shock, accompanying diagnosis, resuscitation methods and outcome.

Variable	Survived	Died	Statistics	P value
Type of shock				
Septic	5 (15.6)	27 (84.4)	33.28	<0.001
Hypovolaemic	21 (95.5)	2 (4.5)		

Variable	Survived	Died	Statistics	P value
Accompanying diagnosis				
Acute diarrheal disease				
Yes	20 (54.1)	17 (45.9)	1.64	0.200
No	6 (35.3)	11 (64.7)		
Pneumonia				
Yes	2 (10.0)	18 (90.0)	18.52	<0.001
No	24 (70.6)	10 (29.4)		
Meningitis				
Yes	2 (13.3)	13 (86.7)	10.08	0.001
No	24 (61.5)	15 (38.5)		
Severe malaria				
Yes	2 (25.0)	6 (75.0)	2.02	0.156
No	24 (52.2)	22 (47.8)		
Venous access				
Peripheral	26 (65.0)	14 (35.0)	17.55	<0.001
Intraosseous	0 (0.0)	14 (100.0)		
Resuscitation				
Fluid only	24 (96.0)	1 (4.0)		
Fluid plus inotropes plus blood	1 (4.8)	20 (95.2)	43.00	<0.001
Fluid plus inotropes only	1 (16.7)	5 (83.3)		
Fluid plus blood only	0 (0.0)	2 (100.0)		
Duration of stay	119.42±75.13	29.86±46.31	5.32	<0.001
<24 hours	0 (0.0)	18 (100.0)		
24-48 hours	0 (0.0)	5 (100.0)	37.2	<0.001
>48 hours	26 (83.9)	5 (16.1)		

DISCUSSION

In five-year review, shock was diagnosed in approximately 1.4% of pediatric emergency admissions. While this appears low, it closely aligns with data from Kenyan hospitals, where a study of over 42,000 admissions found a clinically diagnosed shock prevalence of just 1.45%.[4] Notably, that same study reported that 7.5% of children displayed at least one sign of impaired circulation, suggesting that many cases of early or evolving shock may go unrecognized or undocumented.[4]

The disparity between the number of children with circulation signs and those formally labeled as “shock” supports the idea that diagnostic thresholds, clinician recognition and documentation practices, rather than a genuinely low burden, may explain the relatively low incidence. This interpretation aligns with a systematic review of pediatric shock in low and middle-income countries, which highlighted the wide variation in how shock is defined and diagnosed across studies.[3] Children under one year made up most of the cases in our study. This is similar to what has been reported in other African and Indian studies, where infants tend to be more affected because their physiological reserve is limited and they are more vulnerable to severe infections.[5,8,9] Most of the children came from urban areas, which likely reflects the hospital’s location and the fact that it serves as a major referral point for surrounding facilities. We also found that many of the affected children had mothers with little or no formal education and came from lower socioeconomic backgrounds. This is a trend other studies in southern Nigeria and similar settings have also noted, where social and economic constraints can influence how quickly families recognize illness and seek care.[10,11]

In our study, fever, vomiting, altered consciousness, convulsions, respiratory symptoms and signs of poor perfusion were the most common features at presentation. These findings are in line with what is typically seen in children with infection-related shock in paediatric emergency units.[4,12] Notably, a large number of children in our study presented with altered consciousness and convulsions, suggesting that many arrived with more severe systemic or central nervous system involvement than reported in some other studies.[5,8] This likely reflects delays in seeking care and a higher burden of invasive infections in our setting, which are known to contribute to more severe illness at presentation in resource-limited tertiary hospitals.[3,4] Metabolic and haematologic abnormalities were common in our study. Hypoglycaemia, electrolyte imbalances, anaemia and leukocytosis were frequently observed, similar to reports from Kenya, Ethiopia and other international studies, where such laboratory findings are often seen in children with severe shock or sepsis.[2–5] The high rates of these abnormalities in our study likely reflect the combination of infectious illnesses, malaria and dehydration from

diarrhoeal disease. In this study, septic shock was the most common type, making up nearly 60% of cases. This is similar to reports from India, Kenya and Ethiopia, where infections are also the leading cause of shock in children.[4,5,8] The high prevalence in our study may be explained by the fact that most of the children were infants, whose immune systems are still developing and less able to fight off infections. Assies et al.'s review confirms that sepsis is the main cause of pediatric shock in low and middle-income countries.[3]

In managing these children, care focused on early fluid resuscitation, oxygen therapy, empiric antibiotics, blood transfusions when indicated and vasopressor support, with dopamine being the inotrope used. While dopamine has been historically used, current guidelines recommend first line agents such as epinephrine or norepinephrine in paediatric septic shock.[1,13] Recent paediatric evidence shows that the first vasoactive drug chosen for children with fluid-refractory septic shock may affect their outcomes. Some small randomized and comparative studies have reported that children started on norepinephrine tend to have fewer arrhythmias and may have better survival than those started on dopamine. For example, in a randomized control trial by Chaurasiya et al in India, it was found that dopamine group had a mortality of 50% as compared to 40% in norepinephrine group.[16]

Also, arrhythmias occurred in 27.5% cases in dopamine group and 8.33% cases in norepinephrine group. There was also a significantly greater incidence of sinus tachycardia with dopamine (12.5%) than norepinephrine (5%). Observational studies controlling for key confounders have also suggested that norepinephrine may offer a survival advantage over epinephrine in some settings.[17,18] Overall, the available evidence supports using norepinephrine or epinephrine rather than dopamine as the initial vasoactive agent for paediatric septic shock, even though larger multicentre studies are still needed to guide practice more definitively. The high number of children needing blood transfusion alongside fluid and inotropic support highlights the rapid deterioration that often characterizes paediatric shock, with many progressing quickly to a refractory state. Intraosseous access was needed in about a quarter of cases reflecting difficulty establishing peripheral access in profoundly shocked children a pattern seen in similar resource limited settings.[4,5] Unlike high income settings, our hospital had limited access to advanced support such as mechanical ventilation and invasive haemodynamic monitoring. The overall mortality rate in this study was 51.8%, which is high but comparable to reports from some African settings. Gelaye and Tefera reported a 43% mortality in Ethiopia, while Mbevi et al, documented 30–50% in Kenyan hospitals.[4,5] A higher mortality of over 60% was noted in some Nigerian emergency units.[10,11] Globally, mortality from septic shock in high-income countries is much lower at about 10–20%, reflecting better access to pediatric intensive care.[2] The high mortality reported in many African settings likely reflects a combination of late presentation, limited access to paediatric intensive care, a high burden of septic shock and dependence on emergency-room–based resuscitation rather than continuous intensive monitoring. Several factors were associated with mortality in this study, including delayed presentation, severe malnutrition, low oxygen saturation, hypoglycemia, anemia, electrolyte derangements, leukocytosis, septic shock, intraosseous access and need for inotropes.

These findings are consistent with reports from India, Ethiopia and Kenya, where late presentation and metabolic abnormalities were also among the strongest predictors of poor outcomes.[4,5,8] The need for intraosseous access and inotropes likely indicates refractory shock, which is consistently associated with higher mortality worldwide.[2] Additionally, all children who died did so within 48 hours, a pattern comparable to reports by Fisher et al, who found that early deaths reflect irreversible shock at presentation.[12]

CONCLUSION

Shock remains a serious cause of paediatric morbidity and mortality in our setting, with infants and septic shock being most affected. Most children arrived critically ill and over half died usually within 48 hours reflecting delayed presentation and limited critical-care capacity. Metabolic derangements and the need for intraosseous access or inotropes were markers of poor outcome. Strengthening early recognition, improving referral systems and enhancing emergency and critical-care support are essential to improve survival.

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