ORIGINAL ARTICLE

PATTERN AND OUTCOME AMONG PEDIATRICS PATIENTS ADMITTED TO EMERGENCY WARD WITH SHOCK, IN A 3 MONTHS PROSPECTIVE FOLLOW-UP STUDY, AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ETHIOPIA

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ABSTRACT

Background: *Shock is a life-threatening condition of circulatory failure, causing inadequate oxygen delivery to meet the metabolic demand of the body and the mismatch of oxygen consumption and requirements, producing cellular and tissue hypoxia. This study was done to assess the pattern and outcome of shock of pediatrics patients admitted to the pediatrics emergency unit of Tikur Anbessa Hospital.*

Method: *The study was conducted in the department of Pediatrics and child health at Tikur Anbessa Hospital AAU College of Health Sciences Department of pediatrics and child health Emergency unit between March 1st, 2019 to June 1st, 2019. It was a prospective study of patients admitted during the study period. Children aged 7 days to 15 years with clinical diagnoses of shock were included, after written consent from parents.*

Result*: Out of the total 23 children admitted with shock, 12/23 had septic shock, 11/23 had a hypovolemic shock. The two most common age groups admitted with shock were those between 3 months to 12 months (8/23) and less than one month (7/23). From the total of the study participant, 16/23 children survived and 7/23 children died. Out of all deaths, the most common cause of deaths were septic shock accounts for the death of four out of total deaths of seven.*

Conclusion*: In the present study septic shock is the commonest type of shock and also the highest cause of death. Those patients who did not show improvement with one inotrope who needed two or more inotropes indicate poor prognosis.*

Keywords*: Hypovolemic shock, Mortality, Septic shock*

INTRODUCTION

Shock is defined as a complex state of circulatory dysfunction that results in inadequate delivery of oxygen and metabolic substrates to the tissues with changed physiological status (1). About 10 million children die of shock every year in the world (2). The Clinical manifestations of shock occur because of decreased perfusion to the tissues, this triggers the compensatory mechanisms. (3). Early identification of children with shock is very important to initiate immediate fluid resuscitation, which significantly improves the outcome (4). The criteria for WHO shock include the presence of all three signs of impaired perfusion, weak and fast pulse, cool peripheries plus a CRT >2 seconds (5).

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Shock is one of the most common pediatrics emergency conditions unless it is detected early and managed accordingly; it can be the major cause of mortality; hence timely recognition and treatment of shock with continuous monitoring of clinical and laboratory parameters will improve patient outcome.

In the management of shock, the first hour is the golden hour. Significant reduction in mortality is achieved when >40 ml/kg of isotonic fluids are administered in the first hour, and evaluation and treatment of underlying cause should proceed simultaneously (6).

The most common type of shock are septic shock and hypovolemic shock, in high-income and low-income countries is respectively. The commonest causes of hypovolemic shock seen in low-income countries are secondary to diarrhea/dehydration; however, their prevalence is poorly described in LICs (7,8).

Similarly, as far as the knowledge of the author in Ethiopia, no study has been published on the pattern and outcome of shock in children. This prospective cross-sectional study aimed to address these gaps by exploring the pattern of shock, and outcomes among hospitalized children aged under 15 years, at TASH, pediatrics Emergency unit in the study period.

Methods and Materials

The present study was conducted in the Department of Pediatrics, Emergency unit Tikur Anbesa Specialized Hospital Addis Ababa, Ethiopia, Between March 1st, 2019 to June 1st,2019. It was a prospective study in children age 7 days to 15 years with the clinical diagnosis of shock. The participants were included after written consent from parents and the clinical parameters were compared between survivors and non-survivors. Various factors like age, sex, Systolic BP and heart rate urine output at 24 hours, GCS at admission, the requirement of inotropes (single/multiple), and requirement of mechanical ventilator were compared between survivors and non-survivors.

Data Management: Data was collected by using pre-tested structured questionnaires by trained pediatrics residents and medical interns working in the unit. Interpretations of the metrics were done following the standards provided on the questioners. The quality of the data and completeness were supervised by the principal investigator; before the data entry.

Ethical considerations

The study proposal was reviewed by the pediatric Department Research and Publication Committee. Written ethical approval to undertake this study was given by the Department of research and publication committee. There were consent forms and the participant or caretakers had to give consent before recruited to the study. For confidentiality reasons, the patient names were omitted from the questioner and replaced by specific code numbers. The information collected was kept confidential in a locked cupboard and would only be used for study purposes.

Results

Distribution age and Types of Shock:

Out of 23 studied cases, 15/23 were male with male to female ratio of 1.5:1, the first most common age group was 3month – 12 months (8/16) and the second common age was less than one month (7/23). The most common type of shock in our study participants was septic shock and age distribution were between the age of 3month to 12 months, while hypovolemic shock almost equal distribution for all age group.

Among the types of shock septic shock was the most common 12/23 the rest hypovolemic shock. Out of 23 cases, 16 survived and 7 died. The length of stay in the emergency before death was range from 6 hours to 73 hours and the highest death 4/7 noticed were in septic shock.

Table 1. Distribution of age and types of shock patients admitted to pediatrics emergency unit in TASH from March to June 2019

Age	<1 mon	1-3 mon	3-12 mon	1-5yrs	5-10 yrs	10-15 yrs	Total
Total cases of shock	7/23	1/23	8/23	5/23		2/23	23
Hypovolemic shock	2/23		3/23	4 /23		2//15	11
Septic shock	5	1	5	1			12

Clinical presentation of the patients:

In the present study diarrhea and vomiting were the initial presentations for hypovolemic shock, the most common cause for hypovolemic shock was vomiting 19/23, and 10/23 had additional diarrhea. All patients with septic shock had fever, vomiting, and tachypnea at presentation. The mean RBS of the patients was 138 mg/dl (SD=70.25) and there was no hypoglycemia at admission. Eighteen out of twenty-three patients had oliguria during the first 24 hours of admission. The highest death occurs in females 3/5 and the patient with comorbidity 4/5. The total number of patient needed mechanical ventilator and transfusion were 6/23 and 9/23 respectively from these 4/6 who needed ventilator and 6/9 who needed transfusion had died.

Table 2. Clinical characteristics and management of survivors and non-survivors patients with shock admitted to pediatrics emergency unit in TASH from March to June 2019

Variables	**Characteristics**	**Frequency**	
		Survivors (16)	Non-survivors (7)
Sex	Male	11	4
	Female	5	3
Comorbidity	Yes	5	4
	No	11	3
Vomiting	Yes	12	7
	No	4	0
Diarrhea	Yes	8	2
	No	6	5
Decreased urine	Yes	9	5
	No	7	2
Temperature	Hypothermia	2	0
	Fever	11	7
	Normal	3	0
Pulse rate	Tachycardia	15	7
	Normal	1	0
GCS	15/15	8	5
	Below 15/15	8	2
Mechanical ventilator	Needed	2	4
	Not needed	14	3
Blood transfusion	Yes	3	6
	No	10	1
Inotrope	Yes	5	7
	No	11	0

Management pattern:

Of all 23 patients, 16/23 of them needed oxygen support; 9/16 were given CPAP, 6/16 needed Intranasal oxygen while six patients needed mechanical ventilation.

The mean fluid volume given during initial resuscitation was 20ml/kg (SD=6.17) with an average of 2.6 times fluid bolus given to each patient and the whole bolus of fluid was given in the mean period of 46 minutes (SD±30.25).

The pattern of inotropic uses:

Among non-survivors, 5/7 required multiple inotropes; among survivors, only 2/7 required a single inotrope; which was statistically very significant (p-value of <0.001). Hence need for multiple inotropes was associated with poor outcomes. In the present study, the ventilator requirement was in six patients (6/23), but only one patient got the chance for ventilator support and four patients have died due to lack of ventilator.

Epinephrine drip was used in all septic shock patients, while both epinephrine and dopamine drip was used in 5/12 of septic shock patients.

Table 3. Inotrope requirement of patients admitted to pediatrics emergency ward in TASH with a diagnosis of Shock from March to June 2019

Inotropes	**Survivors (n=5)**	**Non-survival (n=7)**	**P value (Fisher exact test)**
Single inotropes	4	2/7	
Multiple inotropes	1	5/7	<0.001
Total	5/5	7/7	

In the present study, the most common cause for hypovolemic shock was acute gastroenteritis (8/11) followed by diabetic ketoacidosis (2/11), burns (1/11)).

Patient's hospital stays for treatment: Regarding, hospital stays before death, five out of seven has stayed less than 24 hours and 2/7 stayed between 24-48 hours. Most of the survivors has stayed in the hospital before discharge for more than 72 hours.

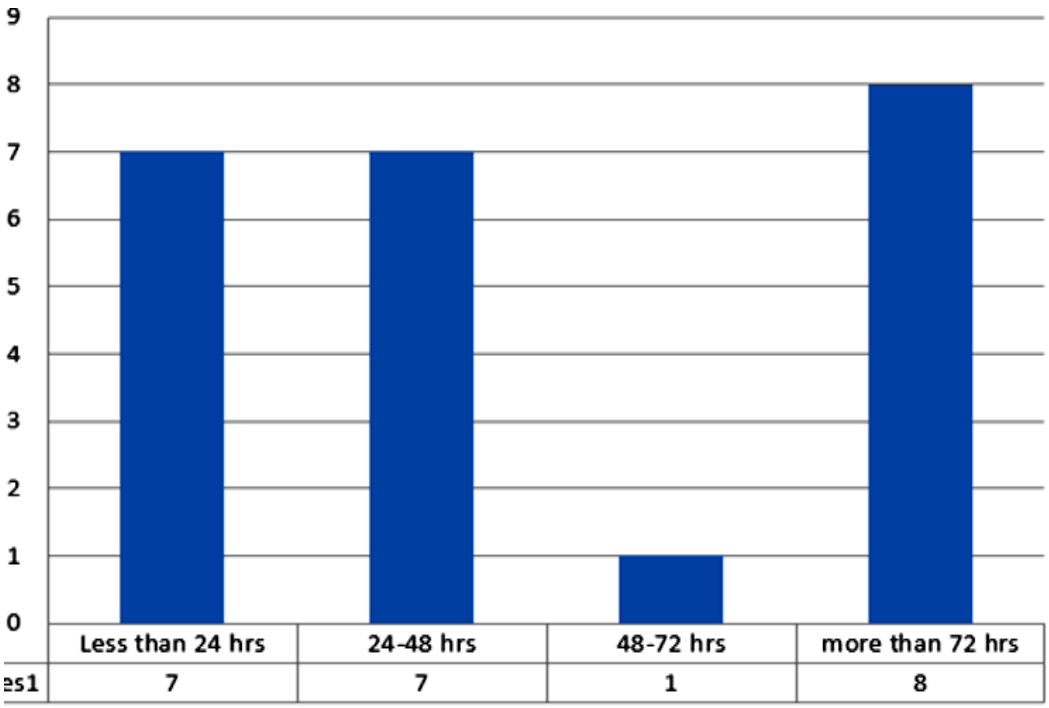

Figure 1. Patient's hospital stays for treatment admitted to pediatrics emergency ward in TASH with a diagnosis of Shock from March to June 2019

Binary logistic regression was done to determine the association between different selected clinical symptoms/signs (fever, fast breathing, diarrhea, decreased urine output, altered mental status, patient respiratory rate, sunken eyeball, grunting, muffled heart sound, and murmur) and with the outcome of the patient which is the dependent variable.

An independent sample t-test was done to see if there is a significant mean difference between survivors and dead patients based on their clinical parameters by assuming the null hypothesis; see table IV.

H0= there is no significant difference in the mean score of survivors and dead patients

HA= there is a significant difference in the mean score of survivors and dead patient

There is a significant mean **GCS** difference between the survivors and dead patients but there is no difference in the mean values of PR, RR, SPO2, and temperature.

Table 4 Comparison of clinical parameters between survivors and non-survivor shock patients admitted to pediatrics emergency ward in TASH with a diagnosis of Shock from March to June 2019

Parameters	**Survivors**		**Non-survivors**		**P values (t-test for independent samples)**	**95 % CI**
	Mean	SD	Mean	SD		
Pulse rate	154.8125	18.4723	164.285	6.15659	0.20	-24.5-5.6
Respiratory rate	54	14.6787	64.1428	17.1311	0.16	-24.7-4.4
Temperature	37.8937	1.2250	38.8142	0.71032	0.8	-1.9-0.11
SPO2	82.3125	14.4347	70.4285	16.26118	0.09	-2.2-26
GCS	14.5625	0.5123	13	2.76	0.036	0.11-3

Association between continuous variables and outcome of patients

An independent sample T-test was done to see if there is any association between continuous variables (the time of fluid bolus given, urine output, time vasopressor given) and patient outcome. The mean values of the amount of RBS, fluid resuscitation volume, fluid boluses given, amount of time the fluid is given, UOP, needed adrenaline amount, amount of time to give the vasopressor and epinephrine amount was compared against the patient outcome. The independent sample T-test shows there is a significant difference in mean UOP (P=0.003) between patients whose outcome becomes alive or died.

Table 5. Association between continuous variables and outcome patients admitted to pediatrics emergency ward in TASH with a diagnosis of Shock from March to June 2019

Variable	**Levene's test**		**Mean difference**	**95% CI**
	F	P-value		
UOP	2.63	0.003	1.3	0.5-2.09

Discussion

In our study, the most common age group affected with shock were less than one month (7/23) and 3 month- 12 months (8/23), similar result was observed in the Indian study (9), which was from the total of 30 participants 21/30 were between the age of 1-6 months and 6-12 months 6/30, the reason for this the lower the age the chance developing shock is higher due to immature immunity.

The present study showed that septic shock was the commonest type accounting for 12/23 of cases, followed by hypovolemic shock 11/23 which is consistent with research done (10), in this study septic shock was the most common cause of shock constituting 57% of total cases. This can be explained by the fact that an infant's immunity is not a well-developed and poor response to any antigen.

Diarrhea and vomiting were the initial presentations of hypovolemic shock in our study 10/23 and 19/23 respectively, which is concordant with another study (11). The reason for these was diarrhea and vomiting, which are common in the developing world as our country.

Among patients whose urine output was monitored,18/23 of patients had oliguria (less than 1 ml/kg/hr.), this finding has similarity to other research done (6) showed decreased urinary output in 81.6% of children. The reason in shock state compromise circulation, if the fluid management, not adequate patients are prone to develop acute kidney injury.

In our study, culture-proven sepsis was not seen as compared to another study (7), and more cases with gram-negative organisms were reported in the literature (8). The explanation of absent culture positive was the majority of the patients' blood culture was not taken due to lack of culture bottles or had received IV antibiotics before being referred to our hospital.

The independent sample T-test showed there was a significant difference in mean UOP (P=0.003) and mean GCS (P= 0.036) between patients whose outcome became alive or died. These had similarities with research done by Alluri Sitarama Raju Academy of Medical, Sciences, Eluru, and Andhra Pradesh, India which was significantly low in non-survivors than in survivors (12).

In our study high mortality (7/12) was observed in septic shock, while there was no mortality in hypovolemic shock which had similarity with research done in Indonesia.

The mortality rate of septic shock was 88.2%. (13). The reason for this inadequate recognition of sepsis leads to missed and delayed diagnosis.

Death was highest in the first 24 hours of admission of septic shock patients. This is consistent with research done by Dr.Varsha Vekaria Hirani which shows 54 % of mortality in 1st 24 hours. (14). This highest mortality could be due to late referrals as all children presented with cold shock and unavailability of enough PICU admission. Infant death was highest in our study

All non-survivors (5/7) required multiple inotropes while the survivors only 5/16 required inotropes; which made a statistically significant p-value of <0.001, hence the requirement of multiple inotropes was associated with poor outcome. The present study has similarities with research done by Alluri Sitarama Raju Academy, India that showed non -survivors 84.2% required inotropic agents of which 52.63% required multiple inotropes while 32.14% survivors required inotropes which is statistically very significant with a p -value of <0.001 (12). The reason for this late admission the state of shock changed from compensated to the un-compensated state of shock patients become unresponsive to fluid management and in need of single or multiple inotropes.

The duration of hospital stay and patients' blood requirement were analyzed against patient outcome but blood requirement was significantly associated with patient outcome. The reason for this there was a delay in blood transfusion due to the lack of blood availability on time.

The requirement of the mechanical ventilator was for the six critical patients, only one patient has got, the rest 5, four died and one has survived without being ventilated this is similar with other two studies (6,15) as supports to our study. The reason for this, patient in shock needs early ventilation that helps to increase the cardiac output (CO) by reducing the work of breathing and oxygen consumption via sedation and provide airway protection for reduced GCS shock patients.

Limitation of the study:

The study lacks statistical power on some of the results to make conclusions based on the findings observed here only, therefore, findings must be interpreted with this caution and those findings need another study with larger sample size and long duration of the study.

Conclusion

The majority of cases were in the age group of between 3-12months and < one month. The most common cause of shock was septic shock followed by hypovolemic shock. The most common cause for hypovolemic shock was acute gastroenteritis. Septic shock had the highest mortality, and especially in the 1st 24 hours of admission. The urine output status of the patient and requirement of blood transfusion determined the outcome. There was an increased need for inotropes and mechanical ventilation in non-survivors as compared to survivors.

Recommendation

Early diagnosis of sepsis, in the initial stages to prevent its progress and rapid therapeutic intervention, is essential in improving the outcome of these patients. The improvement of critical care facilities would reduce mortality.

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