

Original Research Article

A prospective observational study on assessment of types of shock in children and requirement of inotropes in treatment of shock in tertiary care hospital

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Received: 23 February 2021

Revised: 04 April 2021

Accepted: 05 April 2021

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ABSTRACT

Background: Shock is a state of impaired tissue perfusion which result in an imbalance between oxygen demand and supply. This reduction in effective tissue perfusion causes insufficient or improper delivery and distribution of oxygen and nutrients. There is sparse date regarding epidemiology of shock in paediatrics. In this study we were aimed to assess the types of shock and treatment of shock with Inotropes.

Methods: Children of age 1 month to 12 years with a clinical diagnosis of shock were included.

Results: Out of 155 children admitted with shock 72.2% had septic shock, 25.8% had hypovolemic shock, 1.2% had cardiogenic shock, 0.6% had dengue shock. In this study the mortality rate was 8.39% of total patients. The mortality rate of septic shock, hypovolemic shock, cardiogenic shock was 84%, 7.69%, 7.69% respectively. 74.33% of patients were treated with two Inotropes, 5.3% were treated with more than two Inotropes, 11.5% were treated with single Inotropes and 0.88% was treated with no inotrope.

Conclusions: In the present study, among all types of shock the prevalence and mortality rate was more with Septic shock. As shock has high mortality rate in children the early recognition and patient education is required.

Keywords: Hypovolemic shock, Septic shock, Cardiogenic shock, Dengue shock, Inotropes, Mortality

INTRODUCTION

Shock is an acute syndrome in which the circulatory system is unable to provide adequate oxygen and nutrients to meet the metabolic demands of vital organs. Due to inadequate ATP production to support function, the cell reverses to anaerobic metabolism, causing acute energy failure. This energy failure results in the imbalance in homeostasis, the disruption of ionic pumps, accumulation of cytosolic Ca and eventual cell death. Widespread cell death results in multi organ dysfunction.¹ Shock is mainly divided into different types which includes hypovolaemic shock, cardiogenic shock, septic shock and other types includes Traumatic shock, Neurogenic shock and Hypo adrenal shock.²

In both industrialized and developing countries, shock remains the most important risk factor for mortality. In infants, even when controlling for gestational age, birth weight, acidosis, prolonged Prothrombin time, and neutropenia, refractory shock remains the main predictor of mortality.³ About 10 million children die of shock every year in the world.⁴ Once diagnosed, shock has to be managed aggressively. First hour is considered the golden hour. Evaluation and treatment of underlying cause should proceed simultaneously. Airway must be managed as necessary.⁵ All children with shock must be administered high flow oxygen as there is tissue hypoxia.⁶ Rapid boluses of RL or NS at 20 ml/kg in 5-10 mm are given.⁷ In patients with fluid refractory shock, pharmacological support using vasoactive amines is a choice of treatment. The vasoactive

agent of choice in paediatric patients is dopamine. For dopamine refractory cold shock, epinephrine is the recommended second line agent. However, when low mixed venous oxygen saturation and myocardial dysfunction is suspected, dobutamine is more appropriate for improving cardiac index and decreasing after load.⁸

There is limited data on the incidence of shock in the general paediatric population and most of the data is from paediatric intensive care units situated in metropolitan areas. The purpose of the study is to assess the types of shock occurred in children, requirement of various Inotropes in treatment of shock, the mortality rate and the pattern of Inotropes in treatment of shock.

METHODS

This is a prospective, observational study that was carried out in Paediatric Intensive Care Unit (PICU) at Amrutha Hospital, a tertiary care hospital at Hanamkonda during January 2018 to June 2018. Institutional Human Ethical Committee Endorsement was obtained after submission of protocol.

Children with age of 1 month to 12 years with manifestations of shock were included in the study. As it is an observational study, the data was collected from the inpatient department in data collection form according to standard operating procedure and data collected includes complaints of patients, laboratory parameters, diagnosis of disease and treatment. The data for neonates and children who had comorbidities like diabetes mellitus, asthma and other diseases and who died within one hour after admission were excluded. Children are classified based on type of shock as septic shock, hypovolemic shock, cardiogenic shock and dengue shock. Treatment of shock with Inotropes and mortality rate was analyzed.

To analyze the data and to evaluate the results, Microsoft excel-2007 was used and reported the data by graphical representation.

RESULTS

A total of 155 children with shock were analyzed based on signs, symptoms and investigations performed at the time of admission.

Out of 155 children, Males were more affected 102 (65%) compared to Females 54 (35%) (Figure 1). The age between 1M-1yr were more diagnosed 117 (75.5%) followed by the age between 1yr-3 yr 33(21.3%) and >3yrs 5 (3.2%).

At the time of admission elevated body temperatures (>100°F) was present in 126 (81.3%) children and mean temperature was 100.8°F±SD. Arterial blood gas test was performed in 113 children, out of this 86 children had low partial pressure of oxygen (PaO₂) (<75 mmHg), 60 children had high partial pressure of carbon di oxide

(PCO₂) (>42 mmHg) and pH and HCO₃ was normal in all children.

Table 1: Distribution of data according to different types of shock.

Type of shock	Percentage
Septic shock	73% (113)
Hypovolemic Shock	25.2% (40)
Cardiogenic shock	1.3% (2)
Dengue Shock	0.7% (1)

Table 2: Age wise distribution of data in children with different types of shocks.

Type of shock	Age		
	1M-1yr	1-3 years	>3 years
Septic shock	87.61%	8.84%	3.53%
Hypovolemic shock	40%	57.50%	2.50%
Cardiogenic shock	50%	50%	0
Dengue shock	100%	0	0

Table 3: Inotropes used in different types of shock.

	Adrenaline	Dopamine	Dobutamine
Septic shock	76	87	15
Hypovolemic shock	0	0	0
Cardiogenic shock	1	1	
Dengue shock	0	0	0

Table 4: Pattern of Inotropes in septic shock.

Septic shock	Percentage
Single inotrope	11.50%
Two Inotropes	74.30%
More than two Inotropes	5.30%
No Inotropes	0.9%

Table 5: Mortality rate in shock.

Type of shock	Mortality percentage
Septic shock	85%
Dengue shock	7.5%
Hypovolemic shock	7.5%
Cardiogenic shock	0

Out of 155 children, 85 children had low capillary refill time and serum lactate levels were elevated in 82 children, cool extremities were observed in 116 children at the time of admission.

The most commonly diagnosed shock was septic shock 113 (73%), followed by hypovolemic shock 40 (25.5%),

Cardiogenic shock 2 (1.3%) and dengue shock in one patient (0.7%) (Table 1).

Age wise distribution of shock was given (Table 2).

All children with hypovolemic shock were treated with either crystalloid or colloid and antibiotics. Children with other types shock (Septic, Cardiogenic and Dengue) were treated with IV (Intravenous) fluids, antibiotics and Inotropes. Most commonly administered Inotrope was Dopamine followed by Adrenaline and Dobutamine (Table 3).

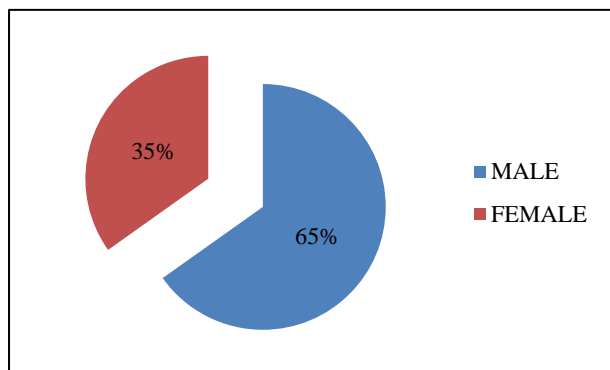


Figure 1: Gender wise distribution of shock.

The pattern of Inotropes in patients with Septic shock was analyzed. The pattern of Inotropes in septic shock includes, single Inotrope was given in (11.5%) children, two Inotropes were given in (74.3%), and more than two Inotropes in (5.3%) and Inotropes were not used in (0.9%) children (Table 4).

Mortality rate in shock patients was 14 out of 155 children. Mortality rate was more in septic shock (85%) compared to other type of shock (Table 5).

DISCUSSION

From the total admissions of the PICU, the frequency of the children who are affected by the Shock was found to be 3.14% in the present study. Comparatively, the frequency of the children who are affected by the Shock were 7.96% in the previous study.⁹

The most common type of Shock in our study was Septic shock which occupies 72.2% of total cases followed by Hypovolemic shock, 25.8%, cardiogenic shock accounts for 1.2% and Dengue shock constituted 0.6%. In previous studies the most common type of shock is Septic shock 69.33% followed by Hypovolemic shock 25.33%, distributive and cardiogenic shock of 2.66%^[9] and in a study by Singh et al, the most common type of shock was hypovolemic shock followed by septic shock, cardiogenic shock and distributive shock.¹⁰ Though hypovolemic shock is recognized as the most common cause of shock in children, it was not the most common cause of shock in

this study. Since ours is a tertiary level hospital, the complicated cases are referred to our PICU.

In the present study the survivors includes 91.61% and non-survivors includes 8.39%. In the present study mortality rate was more in Septic shock patients (84%), in a study mortality rate was more in septic shock patients than in other types of shock.¹¹ Mortality from septic shock was low compared to our study.¹²

In the present study Cardiogenic shock is present only in two cases in which none of the patients were died. In previous studies, the mortality rate of Cardiogenic shock was 100%.⁹

Dengue shock was present in a single patient and this patient was dead. Mortality rate of Hypovolemic shock was 7.61%; in previous studies the mortality rate of Hypovolemic shock was constituted 3.4%.¹¹ Male children were more affected than the female children in our study. In previous study, the male patients constituted 61% and female were 39%.¹¹

Acute GE with dehydration was most common cause of Hypovolemic shock in this study. The common cause of Cardiogenic shock is myocarditis and complex congenital heart disease. And in a study the causes of cardiogenic shock were heart rate abnormalities, cardiomyopathies, and congenital heart disease.¹⁰

The most common cause of Septic shock in this study is underline bacterial infection and in previous studies, the causes of Septic shock were pneumonia followed by sepsis.⁹

In this study treatment of Hypovolemic shock includes aggressive fluids and appropriate antibiotics which follow guidelines.

In our study Dopamine was most commonly administered Inotrope in patients with septic shock. Septic shock requires treatment to support the circulation by the infusion of balanced crystalloid solutions, administration of vasopressors (nor epinephrine, vasopressin if needed), in some cases also inotropic drugs (example- dobutamine), and organ replacement therapy.¹³ Single inotrope was used in patients of 11.5%, two Inotropes are used in patients of 74.33%, more than two Inotropes are used in patients of 5.3% and Inotropes are not used in patients of 0.88% with Septic shock. In Cardiogenic shock more than two Inotropes are used in one patient. This study is limited by several factors. The duration of study was 6 months and time was major limiting factor to collect the sufficient data and to analyze it.

CONCLUSION

Shock constitutes a major percentage of diagnosis in paediatrics. The age below one year children are more affected by shock than other age group of children. Septic

shock was most common type of shock followed by hypovolemic, cardiogenic and dengue shock. Most common cause of septic shock is pneumonia and acute gastroenteritis is for hypovolemic shock. Septic shock has got highest mortality in this study. There was increased need for Inotropes and most commonly administered inotrope was Dopamine. Paediatric shock syndrome is treatable if recognized early. Successful management requires early aggressive fluid resuscitation followed by treatment individualization based on bedside assessment.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kotha JR, Kothapally HK, Pinnoju SC, Kumar S. A prospective observational study on assessment of types of shock in children and requirement of inotropes in treatment of shock in tertiary care hospital. Int J Contemp Pediatr 2021;8:835-8.