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Original Research Article

The Cross-Sectional Assessment of the Prevalence, Possible Etiology and the Response to Treatment and Outcome in Pediatric Patients Admitted with Shock

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Abstract

Aim: To assess the prevalence of pediatric shock in children admitted to Pediatric ICU, to identify possible etiology and the response to treatment and outcome in patients admitted with shock in Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India.

Material & Methods: The cross-sectional study was conducted in Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India over a period of one year. A total of 1783 cases were admitted in PICU over a period of one year.

Results: The total no of pediatric shock cases was 60. Among them 25 were male and 15 were females. In males it was 22/1000 and in females it was 26/1000. The difference between the two groups was not statistically significant.

Conclusion: Septic shock accounts for majority of decompensated shock and poor outcome to management. Infancy decompensated shock, septic shock and those requiring ventilator support were the factors influencing the outcome of management.

Keywords: Airway obstruction, metabolic waste, oliguria, Septic shock

Introduction

Sepsis, or dysregulated host response to infection, is considered a worldwide public health problem. [1] It is a major childhood disease both in terms of frequency and severity. Retrospective studies show that its frequency is increasing in the pediatric population, mainly due to the increased survival of very low birthweight infants and children with chronic conditions. [2, 3] Despite numerous efforts, [3–6] severe sepsis and septic shock are still considered the main cause of death from infection in childhood. [7] It is estimated that there were more than 4 million deaths worldwide in 2013 due to infectious diseases in children under 5 years old, and the vast majority is due to severe sepsis and septic shock. The estimated healthcare cost of pediatric sepsis in the United States in 2005 was $4.8 billion. [8]

Mortality from septic shock remains high worldwide and is influenced by the time of recognition and initiation of goal directed management [9]. Mortality remains high in the initial 72 hours of onset of sepsis and septic shock partly due to the hyper

inflammatory phase (cytokine storm) of the immune response [10]. Presence of low arterial systolic blood pressure and PH, presence of disseminated intravascular coagulation and extent of multi-organ failure have been associated with poor outcomes [11]. A study in India showed a 96 hours mortality of 70% [12].

Most effective and sensitive physiologic status monitoring repeatedly by a competent and experienced physician cannot be replaced by the best monitors. 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. [13] All children with shock must be administered high flow oxygen as there is tissue hypoxia. Intubation may be required in the following situations. Vascular access must be achieved rapidly. If not after 90 seconds, intraosseous route could be used to administer isotonic fluids which are the first-choice fluids for correction of shock. Rapid boluses of RL or NS at 20 ml/KG in 5-10 min is given. Reassessment is done, and further fluids administered depending on the clinical situation. Significant reduction in mortality is achieved when >40 ml/kg of isotonic fluids are administered in the first hour. No difference in occurrence of ARDS due to rapid fluid blous has been noticed in between groups of patients who were given large boluses and groups given lower volumes. [14]

Material & Methods:

The cross-sectional study was conducted in Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India over a period of one year. A total of 1783 cases were admitted in PICU over a period of one year.

Inclusion criteria:

- All patients between ages of 1-month and 12 years admitted to Pediatrics ward of Darbhanga Medical College and Hospital, Darbhanga.

Exclusion criteria:

- Neonates are excluded from the study.
- All sick children admitted to Pediatric Intensive Care Unit of Darbhanga Medical College and Hospital, Darbhanga, with the suspicion of shock were assessed by using the rapid cardiopulmonary assessment and diagnosed suffering from shock.

Possible etiology, type and severity of shock was arrived at using a targeted history, clinical examination and relevant laboratory investigations. These children are managed as per the pediatric advanced life support guidelines for shock with modifications for individual cases as necessary. The outcome of treatment is studied. Children are classified based on severity as compensated or decompensated shock and based upon their etiology as hypovolemic, cardiogenic, septic, distributive, anaphylactic or obstructive.

The data obtained were classified, analyzed and interpreted with the help of statistical package SPSS version (13.0) at the 5% level of significance.

Results:

Basic demographic details were demonstrated in table 1. Sample size was 100 children. The subjects were studied and described according to their demographic characteristics namely sex and age. The total no of pediatric shock cases was 60. Among them 25 were male and 15 were females. Table 2 explains the prevalence as 29/1000 patients. In males it was 22/1000 and in females it was 26/1000. The difference between the two groups was not statistically significant.

All children who had unstable airway or bradypnea, were having decompensated shock and except one among them all expired despite prompt airway

management. Respiratory distress was noticed in 41 (68.3%) children and all of them had either cardiogenic, septic shock or a combination of both. Capillary refill time was prolonged in 51 (85%) children. Decompensated shock as evidenced by low blood pressure was seen in 83.3% children. All of them had altered mental status. Urinary output was monitored in 55 children of which 48 (80%) had oliguria. (Table 3)

Among the 60 cases studied, septic cases was the major type among infants and 31% among the total group. This did not include the septic/cardiogenic type which accounted for 14% of cases. Hypovolemic was seen in 18% of cases and distributive in 20% of case. Cardiogenic shock was seen in 13%. 3% had anaphylactic shock and another 1% had neurogenic shock . (Figure 1)

Of the 48 children whose liver function test were available, 15 had elevated values, 9 from the decompensated category and 7 from the compensated category. The difference was not statistically significant ($t = 1.381$ d.t 61 and $p>0.05$). Renal function tests were done only in 52 children and liver function tests were done only in 40 children during the study due to difficulty in obtaining blood sample due to severity of shock while presentation and shorter duration of stay in the hospital. Of the 52 children whose renal function test were available, 21 had elevated values, 13 from the decompensated category and 6 from the compensated. The difference was statistically significant ($t = 2.62$ duff 50 and $p <0.05$). (Table 4)

Death and improvement following management of shock were the two variables measured in study. Among the septic shock category 9 improved and 10 died. Among cardiogenic shock 4 improved and 1 died. Both were not statistically significant. Where as in hypovolemic shock 6 improved and 1 died and the difference was statistically significant in children who had both septic + cardiogenic shock only 1 survived and 8 died which was also significant statistically. (Table 5)

Table 1: Age and sex wise classification of trials.

Age	Male	%	Female	%	Total	%
< 12 years	14	56	7	46.67	30	50
1-5 years	3	12	4	26.67	15	25
5-10 years	6	24	3	20	10	16.67
> 10 years	3	12	1	6.66	5	8.33
Total	25	100	15	100	60	100
Range	1 month to 12 years		1 month to 10 years		1 month to 12 years	
Median	12.2 months		12.1 months		12 months	
Mean	44.3 months		33.2 months		35.4 months	
SD	47.6		38.2		39.8	

Table 2: Sex wise distribution of pediatric shock cases

Sex	Total children admitted in ward /PICU	Total children admitted with shock	%	Prevalence per 1000/p
Male	1007	25	2.4	22/1000
Female	776	15	1.9	26/1000
Total	1783	60	3.3	29/1000

Table 3: Clinical findings

Clinical finding	No.	%
Unstable airway/Bradypnea	30	50
Effortless tachypnea	46	76.67
Respiratory distress	41	68.33
Tachycardia	55	91.67
Relative/absolute bradycardia	23	38.33
CRT prolonged	51	85
Flash refill	9	15
Blood pressure low	50	83.33
Liver span increased	32	53.33
Altered mental status (AJV/P/U)	60	100
Urinary output (>1ml/kg/hr)	48	80

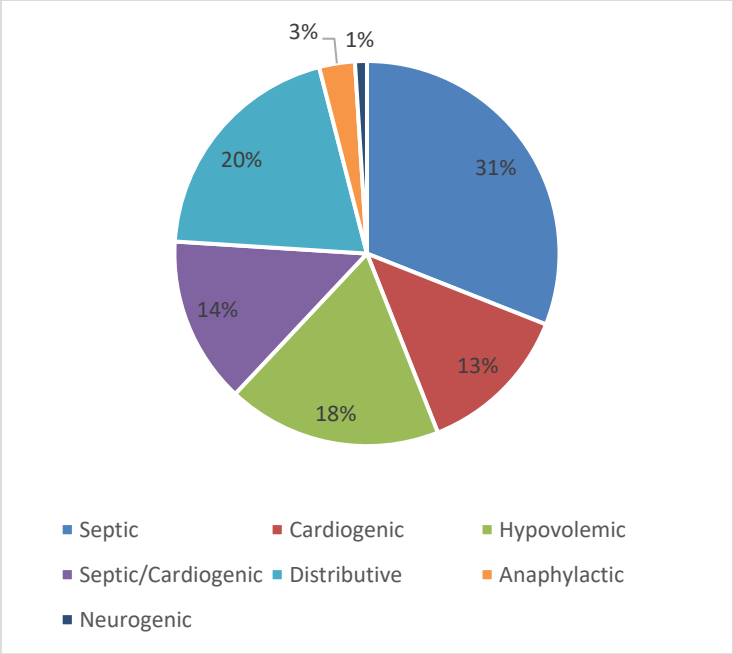

Figure 1: Percentage of distribution of etiology of shock.

Table: 4 Renal function and liver function tests in children with shock

RFT And LFT Elevated	Compensated	De-compensated	Total intubation required
	No.	No.	No.
RFT ↑	6	13	21
LFT ↑	7	9	15

Table 5: Outcome based on etiological classification

Etiology	Improved	Died	p-value
	No	No	
Septic	9	10	p>0.05
Cardiogenic	4	1	p>0.05
Hypovolemic	6	1	p>0.05

Septic / cardiogenic	1	8	p>0.01
Distributive	3	5	p>0.05
Anaphylactic	1	0	p>0.05
Neurogenic	1	0	p>0.05
Total	25	25	

Discussion:

Studies analyzing the demographic profile and prevalence of shock in pediatric patients who present to a tertiary care hospital are very few in both western and Indian literature. Sex wise distribution of shock patients did not show any significance though of those children admitted, 846 were females and 1189 were males and 3% and 2.7% of them respectively were diagnosed to have shock. [15] Neither did the severity of shock - compensated nor decompensated have any difference among the two sexes. All 57 cases were assessed by rapid cardiopulmonary assessment at presentation and the data of clinical findings obtained is discussed below. The most consistent finding noticed in the cases was altered level of sensorium at presentation. [16]

In South America, de Souza et al [17] observed that both the prevalence of severe sepsis (25.9%) and septic shock (19.8%) at admission to the PICUs were high. In that study, sepsis-related mortality was 14.2% and was consistently higher with increasing severity: 4.4% for sepsis, 12.3% for severe sepsis, and 23.1% for septic shock. One in four deaths of sepsis patients occurred within the first 24 hours after admission to the PICU. The authors found that the prevalence of sepsis was higher in children under 1 year of age (50.4%) and decreased in adolescents (1.9%).Multivariate analysis showed that higher Pediatric Risk of Mortality (odds ratio [OR], 1.06; 95% CI, 1.02–1.11; p ¼ 0.005) and Pediatric Logistic Organ Dysfunction (OR, 1.06; 95% CI, 1.02–1.11; p ¼ 0.015) scores, the presence of two or more chronic conditions (OR,2.74;95%CI,1.4–5.36;p ¼ 0.003), and admission from pediatric wards (OR, 2.44; 95% CI, 1.19– 5.01; p ¼ 0.015) were independently associated with death. Jaramillo-Bustamante et al [18] reported that half of children with sepsis admitted in 19 PICUs in Colombia were in advanced stage of the disease (i.e., septic shock) and over 40% had multiple organ dysfunction syndrome which probably have contributed to the high mortality rate of septic shock (34%).

The initial 72 hours are critical in the management of septic shock and improvement in survival [19-20]. In the continuation of septic shock care at 24 and 48 hours, clinical signs were recorded in a range of 19–100%. Blood pressure was measured only in less than a quarter of the patients and this may have been due to lack of proper cuff sizes in the wards. KNH has limited intensive care resources in terms of PICU/ NICU bed availability, hence only few children manage to receive this care. We could not find a similar study to compare outcomes at 24 and 48 hours of audit of septic shock as most studies focus on the 1st one-hour which is the golden hour in septic shock. Not all variables were measured as per SSCG 2012 Guidelines due to limitations on laboratory, equipment availability (monitors, blood pressure cuffs and staff shortage to closely monitor the children with septic shock).

Studies in adults and children have shown that educational programs are effective in increasing knowledge related to sepsis, adherence to treatment of severe sepsis

and septic shock bundles, and in reducing mortality from this disease. [21-23] Implementation of guidelines to treat pediatric severe sepsis results in early identification of children with sepsis and promotes a significant reduction in the starting time of the intervention and in the variability of treatment, decreases the rates of acute renal failure and the need for renal-replacement therapy, and improves outcomes. [24-30]

Larsen et al observed a significant increase in adherence to the early administration of antibiotics (<3 hours), the fluid bolus administration in the first hour, and the oxygen supply after implementing a screening and a treatment protocol for septic shock in the emergency room. [24]

Conclusion:

Septic shock accounts for majority of decompensated shock and poor outcome to management. Infancy decompensated shock, septic shock and those requiring ventilator support were the factors influencing the outcome of management.

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