

A Clinical Profile of Shock in Children in Punjab, India

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This prospective study was conducted to determine the frequency, etiology, type and outcome of shock in hospitalized children in the age group of 1 month to 15 years. There were 98 cases of shock, constituting 4.3% out of total admissions. Mean age was 2.8 ± 3.4 years. Maximum number of patients (39) was seen in infancy. Hypovolemic shock due to acute diarrheal disease was the commonest type (45.9%) followed by septic, cardiogenic and distributive shock. Compensated stage was common in hypovolemic shock (88.9%) whereas majority of patients with septic shock (73.5%) presented in decompensated stage. Overall survival was 73.6%. The survival rate was best in hypovolemic shock (97.7%) followed by septic (53.3%) and cardiogenic shock (43.7%). Inotropes and ventilatory support were required in 46% and 23% patients, respectively. Diagnosis and management of shock in compensated stage carried better prognosis than in uncompensated shock irrespective of the age of the patient.

Key words: Cardiogenic, Hypovolemia, Septic, Shock.

THE clinical syndrome of shock, a clinical state characterized by inadequate tissue perfusion, is one of the most dramatic, dynamic and life-threatening problems faced by the physician in the critical care setting(1). It accounts for more morbidity and mortality in children worldwide than any other diagnosis(2,3). There is a paucity of data on the epidemiology of shock in developing countries. This prospective study was done to determine the frequency, etiology, and outcome of shock in children as presenting to a tertiary care referral hospital in Punjab.

Subjects and Methods

All children between 1 month and 15 years of age admitted with the clinical evidence of shock in the pediatric emergency from July 2001 to December 2002 were included. Shock was identified by the presence of at least one of the following parameters *i.e.*, tachycardia and/or hypotension along with signs of systemic hypoperfusion(4).

- (a) Tachycardia: Infants >160 beats per minute, toddlers >140 bpm, school going age >120 bpm, adolescents > 100 bpm(5).
- (b) Hypotension: Systolic blood pressure in Infants <70 mmHg; above 1 year <70 mmHg + (2 × age in years)(4).
- (c) Signs of systemic hypoperfusion were taken by noting the following: pulse location, pulse volume, skin temperature/color, capillary refill time >2 seconds, level of consciousness, urine output(4).

Patients were classified into compensated or decompensated shock according to the presence of hypotension. Warm septic shock was identified by the presence of bounding pulses, CFT <2 seconds, wide pulse pressure, normal urine output. Cold septic shock was identified with the presence of hypotension and cold extremities(5,6). Shock was then classified functionally into hypovolemic, cardiogenic, septic and distributive on the basis of history and physical examination.

The patients were managed according to the protocol adapted from Textbook of Pediatric Intensive Care(3) and as per PALS guidelines(4). Appropriate antibiotics were started in all suspected cases of septic shock. Arterial blood gases, hemoglobin, total and differential blood count, platelet count, peripheral blood film, blood glucose, renal function tests, and chest X-ray were done in all cases. Other investigations like blood culture, C-reactive protein, liver function tests, urine routine and culture, stool routine and culture, calcium, urine electrolytes, *etc.* were sent in required cases.

The clinical profile and outcome of the cases were statistically analyzed. The data collected in respect of various variables was analyzed by using Z-test and *t*-test. The significance of the tests was seen at 5% and 1% level of significance.

This study was approved by the research ethics committee of Dayanand Medical College and Hospital and informed consent was taken to enroll the patients for study.

Results

Total 98 children presented with shock accounting for 4.3% of admissions. There were total 2274 patients admitted in the study period. Of these, 632, 477 and 1165 were in the age groups of 1 mo-1 yr, 1-3 yr and >3

year. Shock constituted 6.2%, 7.1% and 2.1% of admissions in these age groups, respectively ($P < 0.05$). Mean age was 2.8 ± 3.4 years with male-female ratio of 1.6 : 1. Age wise distribution of various types of shock is shown in *Table I*.

Nearly 60% of cases were in compensated stage of shock, which was not significantly related to age. Most common underlying etiology in hypovolemic shock was dehydration following diarrhea and vomiting in all the age groups making it statistically significant ($P < 0.05$) cause of hypovolemia as compared to other causes. Only 3 patients with septic shock had positive blood culture and all grew *Staphylococcus aureus*. In cardiogenic shock, congenital heart disease was the most common underlying etiology (53.0%) followed by cardiomyopathy (23.5%) and heart rate abnormalities (23.5%). In 2 cases of distributive shock one patient had skin rash, edema and shock; other had electric current followed by shock. In hypovolemic shock, 40 (88.9%) patients were in compensated stage ($P < 0.01$), which was only in 27% cases of septic shock; this was also significant ($P < 0.05$). Outcome as per the stage of shock is shown in *Table II*.

Seven patients could not complete the study as they left against the medical advice. These were excluded from further evaluation

TABLE I—Age Wise Distribution of Types of Shock

Age	1 mo-1 year	1-3years	>3years	Total
Total cases of shock	39(39.8%)	34(34.7%)	25(25.5%)	98
Shock as per cent of total admissions	6.7	7.1	2.1	4.3
Hypovolemic shock	15(38.5%)	17(50%)	13(52%)	45
Septic shock	16(41%)	8(23.5%)	10(40%)	34
Cardiogenic shock	8(20.5%)	8(23.5%)	1(4%)	17
Distributive shock	0	1	1	2

(2,4,1 in hypovolemic, septic and cardiogenic shock respectively). Sixty seven patients (74%) survived. The survival rate was not statistically different in various age groups. Survival was maximum in hypovolemic shock (42/43) ($P < 0.01$), followed by 53.3% (16/30) and 43.7% (6/16) in septic and cardiogenic shock respectively. Out of 24 patients who expired, 23 were admitted with decompensated shock, 19 had multiorgan failure. Twenty-two patients required ventilatory support and mortality in this group was 70%.

Forty-five patients required inotropic support, and 24 died. All the non-survivors had duration of stay for less than 48 hours and were on inotropes till the end. Out of 24 patients who died, 7 had duration of stay <6 hours, 11 between 6-24 hours and 4 survived for nearly 48 hours. In survivors, 6 patients needed inotropes for 12-24 hours, 11 between 24-48 hours and 4 patients were on inotropes for more than 48 hours.

Discussion

The frequency of shock was found to be 4.3% in the present study. According to Western data, shock occurs in approximately 2% of all hospitalized children and adults in the United States(7). However, there is no such data on the incidence of shock in developing countries. This study showed that maximum patients were observed in infancy.

Hypovolemic shock due to diarrhea and vomiting was the most common type of shock in the present study as is also reported by previous studies(3,4,8-12). However, there is little data on its true incidence(9).

The incidence of septic shock is increasing the world over, with a 10 fold increase in the past 20 years, the reason being that more patients are surviving with the diseases which were fatal previously and due to increase in invasive procedures which constitute risk factors for developing sepsis(11,13). In this study culture proven sepsis was seen in very few cases as compared to other studies(14), and more cases with gram negative organisms(15,16) reported in literature. Less culture positive cases can be explained as majority of the patients had received IV antibiotics before being referred to our hospital.

Cardiogenic shock during infancy and childhood represents a diagnostic and therapeutic challenge because of its myriad etiologies(1). Heart rate abnormalities, cardiomyopathies, congenital heart diseases are the common underlying causes in cardiogenic shock. Main determinant of survival was the stage rather than the age of the patient. This is in conformity to the fact that in compensated stage, vital organ perfusion is maintained by intrinsic mechanism(1,3,4,8) and early

TABLE II—Stage and Outcome of Various Types of Shock

Types of shock	Compensated stage	Decompensated	Survival (%)*
Hypovolemic	40	5	42(97.7%)
Septic	9	25	16(47%)
Cardiogenic	10	7	7(43.7%)
Distributive	2	0	2(100%)
Total	59	39	67(73.6%)

*Survival is calculated after excluding patients who left against medical advice.

Key Messages

- Shock is more common in infants than in other age groups. It is the stage of shock rather than the age of the patient which determines the outcome.
- Hypovolemic shock due to diarrhea and vomiting is the commonest type of shock, which also has the best prognosis if detected early.
- Septic shock presenting in the uncompensated stage is associated with high mortality.

detection and management of shock increases the rate of survival before hypotension develops(3,9). Majority of the patients with septic shock were in decompensated stage at the time of admission, as septic shock is difficult to detect in early stages(3,8,15). High mortality was observed in septic shock in this study (47%) which is also reported in the literature to be as high as >50%(16), though the mortality rates have declined steadily over the past several decades to less than 20%(17). In all types of shock crystalloids initially are the initial fluid of choice(18,19,20) which were used in this study also.

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