Original Research Article

A study on assessment of various clinical parameters and outcome in children with shock in a tertiary care hospital Andhra Pradesh, India

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Abstract

Introduction: Shock is an acute, complex state of circulatory dysfunction, one of the commonest paediatric emergencies. A study was conducted to categorize the shock states in children based on etiology and also to find the association of various clinical and laboratory parameters of shock with outcome. **Materials and methods:** Study was conducted in the department of paediatrics, ASRAM, Eluru from December 2014 to June 2016. Children aged 1 month to 12 years, those admitted with clinical diagnosis of shock were included and neonates, non cooperative were not considered. Thorough and detailed clinical examination as well as history was taken. Battery of tests were considered in the diagnosis of shock and also blood pressure, oxygen saturation etc were also analysed. Chi square test was used to find the association between variables. **Results:** Septic shock was the predominant followed by hypovolemic shock. Most of these were survivors and etiology wise, death wise highest in hypovolemic shock. Mean CRT at the time of admission was almost similar among the groups; but it was decreased in non survivors after 24 hrs; statistically the difference was significant. **Conclusion:** Septic shock was diagnosed to be the commonest and death rate was reported to be highest in hypovolumeic shock. There was significantly lower levels of clinical parameters at the time of admission and inotrope usage was highest among the non survivors.

Keywords: Mortality, Shock, Septic shock, Hypovolemic shock

Introduction

Shock is an acute, complex state of circulatory dysfunction, one of the commonest paediatric emergencies[1]. It is not a problem of blood pressure or blood volume, but whatever the causative factor is, it is always a problem of inadequate cellular sustenance[2 – 4]. Shock can be caused by any serious disease or injury. This is the final common pathway to death. When oxygen delivery fails to meet cellular oxygen demands, various compensatory mechanisms are activated. Shock, therefore, is a dynamic process; the exact cardiorespiratory pattern clinically detected depends on the complex interaction of patient, illness, time elapsed, and treatment provided[5 – 6].

An initial insult triggers shock, leading to inadequate oxygen delivery to organs and tissues. Five major types, namely hypovolemic, cardiogenic, obstructive, distributive and Septic shock are the divisions[7]. Decreased cardiac output and Capillary refill time (CRT) > 2 seconds are the common finding in all these 5 types; these leads to Low blood pressure (BP), narrow pulse pressure, BP sometimes undetectable.

Usually this is diagnosed based on clinical grounds. Correct history and the clinical evaluations facilitate early etiologic classification of shock. This can help in directing appropriate treatment[8]. Laboratory findings often include evidence of hematologic abnormalities and electrolyte disturbances[5]. With these, a study was conducted to categorize the shock states in children based on etiology and also to find the association of various clinical and laboratory parameters of shock with outcome.

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Materials and methods

Settings

Study was conducted in the department of paediatrics, ASRAM, Eluru, Andhra Pradesh.

Duration and type of study

This was a prospective and observational study, conducted from December 2014 to June 2016.

Sampling method

Random sampling was considered.

Sample size calculation

All the eligible members who satisfy the inclusion criteria were considered in this study.

Inclusion criteria

Children aged 1 month to 12 years, those were admitted with clinical diagnosis of shock were included in this research.

Exclusion criteria

Neonates, who were not cooperative and parents of those who didn't submit the informed consent were excluded from the study.

Data collection, procedure

Thorough and detailed clinical examination as well as history was taken from the parents of the study volunteers and these findings were recorded Battery of tests were considered in the diagnosis of shock; even as per the literature also a single tests does not exist in the diagnosis of shock[7, 9].

Shock was diagnosed by recorded blood pressure which was <2 SD below the mean and if any of the three parameters were satisfied among the given five. These were, decreased peripheral pulses, mottled or cool extremities, prolonged CRT>2 sec, tachycardia with mean heart rate >2 SD above normal for age in absence of external stimuli, chronic drugs or painful stimuli and oliguria where the urine output is <0.5 ml/kg/hr.

The recorded blood pressure was <2 standard deviations (SD) below the mean for age and/or a state in which at least any three of the criteria such as decreased peripheral pulses, mottled or cool extremities, prolonged capillary refill time was >2 sec, tachycardia and Oliguria. Mean heart rate was >2 SD above normal for age in

absence of external stimuli, chronic drugs or painful stimuli was considered as tachycardia and a urine output of <0.5 mL/kg/hr was categorised to be oliguria.

Heart rate was obtained from the multichannel monitoring and pulse was felt and features were recorded. SpO2 was measured by pulse oximeter. All the patients were catheterized and the urine output was measured. Arterial blood gas analysis was done and pH, partial pressure of carbon dioxide (PaCO2) and partial pressure of oxygen (PaO2) values were noted. Subsequently blood was taken for hematological studies and biochemical parameters.

Ethical consideration and permission

The study protocol was approved by the institutional ethics committee. This study is on paediatric age group, hence an informed consent was taken from the parents of the participants.

Statistical analysis

SPSS 21.0, was used for the analysis of the data. Chi square test was used to find the association between variables and P < 0.05 was considered statistically significant.

Results

In this study, total 942 members were included and in these shock was diagnosed in 75. Among the 75 (100%) shock cases, septic shock was the predominant (52; 69.3%) followed by hypovolemic shock (19; 25.3%). Distributive and cardiogenic shock were diagnosed to be similar (2; 2.7%), respectively (Table 1).

Table 1: Incidence of different shocks among the study members

Etiology of shock	Number	%
Septic shock	52	69.3
Hypovolemic shock	19	25.3
Distributive shock	2	2.7
Cardiogenic shock	2	2.7
Total	75	100

Septic shock is the highest followed by hypovolemic shock.

In the study members, out of the 75 (100) shock diagnosed cases, 74.6% were survivors and 25.4% were non survivors. Etiology wise, it was 49.3%, 20% in hypovolemic shock, 22.6%, 2.6% in septic shock, 2.6%, 0 in distributive shock and 0, 2.6% in cardiogenic shock, respectively (Table 2).

Table 2: Outcome for different types of shock among the study participants; n (%)

Etiology of shock	Survivors	Non survivors	Total
Hypovolemic shock	37 (49.3)	15 (20)	52 (69.3)
Septic shock	17 (22.6)	2 (2.6)	19 (25.3)
Distributive shock	2 (2.6)	0	2 (2.7)
Cardiogenic shock	0	2 (2.6)	2 (2.7)
Total	56 (74.6)	19 (25.4)	75 (100)

Maximum survivors were in hypovolemic shock and it was 0 in cardiogenic shock.

Mean CRT at the time of admission was almost similar among the groups; but it was decreased in non survivors after 24 hrs; statistically the difference was significant. Similarly, the mean GCS, SpO2 and urine output were decreased in non survivors; statistically the difference was significant (Table 3).

Table 3: Comparison of different clinical parameters among the study participants

Parameter	Survivors		Non survivors		P value
	Mean	SD	Mean	SD	
CRT at admission	5.30	1.159	5.68	1.204	0.239
CRT at 24 hrs	2.16	0.532	3.50	0.760	<0.001
GCS at admission	12.21	1.979	10.21	1.548	0.001
SpO2 at admission	94.52	4.760	88.68	7.056	0.003
Urine output	1.66	0.701	1.05	0.433	<0.001

The mean parameters were low in non survivors and it was statistically significant.

In this research, 74% of non-survivors require ventilator support and it was just 16% only among the survivors; statistically the difference was significant. Among the non survivors, 84% required inotropes whereas just 32% survivors only required; statistically there was significant difference (Table 4).

Table 4: Inotrope requirement among the study participants; n (%)

Inotrope	Survivors	Non Survivors
No	38 (67.8)	3 (15)
Single	9 (16)	6 (31)
Multiple	9 (16)	10 (53)
Total	56 (100)	19 (100)
Statistical analysis	P <0.001; significant difference	

More number of non survivors require inotropes; the difference was significant.

Discussion

In the present study, shock was diagnosed in 7.96% (75/942) of total admissions in the PICU. In a study done by Ravikanth et al.[10] at Indira Gandhi Institute of Child Health (IGICH) Bangalore, shock was accounted for 12.7% of total admissions in PICU. In another study done by Daljit Singh et al.[11], shock accounted for 4.3% of PICU admissions**.** Septic shock in this report was the predominantly (52; 69.3%) diagnosed followed by hypovolemic shock (19; 25.3%) and distributive and cardiogenic shock, 2.7% each respectively (Table 1). The present study was conducted in a tertiary level hospital, complicated cases were referred to this PICU. Hence more incidence of septic shock was diagnosed. In the literature also there was increased incidence of septic shock[12]. This is mostly because more patients are surviving with the diseases which were fatal previously and also due to increase in invasive procedures[11]. Hypovolemic shock was reported to be 25.3% in this study. This finding is at par with the reported results, where it was reported to be 24% and 32% respectively by Eric A Pasman et al. [12] and Chang P et al. [13].

The mortality in shock depends on the Etiology[14]. Etiology wise, in this report, death rate was 20%, 2.6%, 0 and 2.6% respectively in hypovolemic shock, septic shock, distributive shock and cardiogenic shock (Table 2). Similar mortality rates were also reported by Chang P et al. [13] and Kamble TK et al. [15]. In the available literature, it

was reported to be 0 – 20%[16].Statistically there was no significant difference in CRT at admission, whereas at 24 hours after admission it was significantly lower in survivors (Table 3); Ravikanth et al. [10] also reported similar findings. It was mentioned in a study that delay in CRT was found to be useful prognostic factor along with other clinical variables[17]. GCS in this study at admission was significantly low in non-survivors, it was statistically significant. Raicevic R et al. [18], the level of consciousness was in positive correlation with outcome, and GCS <8 was an independent predictor of mortality in a new prognostic scoring system for meningococcal shock[19]. In another study done by Robert F.Wilson and Ronald Krome[20]. On factors affecting prognosis in clinical shock, coma is a poor prognostic factor as deep coma was usually associated with deterioration of other systems of the body. Whereas Kana ram Jat et al. [21] mentioned that GCS was not significantly different between survivors and non-survivors. In trauma and high-risk surgical cases in adults, SpO2 by using pulse oximeter was found to be significantly higher in survivors than in non-survivors[22]. In adult surgical patients with shock, SpO2 measured was higher in survivors[23]. In the present study, SpO2 at admission predicted the survival. The urine output was significantly low in non-survivors. Low urine output was a strong indicator of poor prognosis in adult cases of septic shock[17]. Which was also associated with poor prognosis in adult surgical cases with shock[22]. Anuria itself is a bad prognostic sign because it reflects or is associated with general deterioration.

Among non-survivors, 84.2% of patients required inotropes of which 52.63% of patients required multiple inotropes and among survivors only 32.14% required inotropes, which was statistically significant (Table 4). Hence requirement of multiple inotropes was associated with poor outcome. In a study done by Delgado et al. [24], the requirement of inotropes especially multiple inotropes was associated with poor outcome. Similar result was also obtained in another study done by A Haque et al[26].

Conclusion

Septic shock was diagnosed to be the commonest and death rate was reported to be highest in hypovolumeic shock. There was significantly lower levels of clinical parameters at the time of admission and inotrope usage was highest among the non survivors.

What this study adds new knowledge

There was significantly lower levels of clinical parameters at the time of admission and inotrope usage was highest among the non survivors.

Limitations of this research

Study on small number of shock cases is the major limitation of this research.

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