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Original Research Article

To Analyze Predictors of Poor Outcome in Septic Shock: A Hospital Based Cross Sectional Study

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Abstract

Aim: The present study was undertaken to analyze predictors of poor outcome in septic shock.

Methods: The study was carried out in the Pediatric Intensive Care Unit of the Department of Pediatrics at a Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India. It was a prospective, observational study done in a time period of 10 months. During the study period of 10 months, total 120 cases were admitted in PICU. There were 90 cases of shock of different etiologies and of these 57 cases of septic shock were enrolled in the study. Among the enrolled patients 3 did not give consent to participate in the study, 4 patients left against medical advice and 10 patients expired during the course of the illness. Forty of 50 (40/50 = 80 %) cases enrolled in the study were discharged after recovery while 10 (10/47 = 20%) expired.

Results: On evaluating the role of different demographic, clinical and laboratory parameters between survivors and non- survivors for their association with mortality, only delayed capillary refill time on admission (p=0.007) and low mean pH (p=0.007) showed a statistically significant association with mortality.

Conclusion: A delayed capillary refill time on admission and a low mean pH were statistically significant predictors of mortality in septic shock, in this study.

Keywords: Septic shock, Multi-organ dysfunction, pediatric risk of mortality scoring, sepsis

Introduction

Pediatric sepsis remains as a major cause of mortality and morbidity worldwide. It includes a clinical spectrum of severity - Systemic Inflammatory Response Syndrome (SIRS), sepsis, severe sepsis, septic shock and multi-organ failure. It is important to identify the determinants that predict the progression and mortality in SIRS, so as to deal with such patients in a timely manner. There are very few Indian studies conducted on such determinants. [1]

Sepsis is the most common cause of morbidity and mortality in pediatric

population, in the developing countries. [2,3] The global data on sepsis estimates that infection accounts for more than 80% mortality in under-five children. Septic shock is a dreaded an potentially fatal complication of sepsis.

Assessment of severity of illness at admission is important for effective patient management, prognostication, and optimum utilization of resources. [4] Patient's outcome in PICU of developing country is affected by not only by clinical diagnosis at admission but also by demographic characteristics of the population, available infrastructure, and admission policies of PICU. Simple interventions such as early rapid fluid administration, early antibiotics therapy, oxygen supplementation, and early use of inotropes through peripheral intravenous access have shown to improve the outcome of pediatric sepsis. [5]

In India, overall mortality rate in patients with pediatric septic shock is around 47% which is comparable to global figure of around 50%. [6] However, even when considering such high mortality figures, very few studies have been done till date to assess predictors of outcome in septic shock, especially in Indian scenario, to the best of our knowledge.

Although sepsis is one of the leading cause of mortality in hospitalized patients, information regarding predictive factors for mortality and morbidity are limited, especially in developing countries. [7-10]

The present study was undertaken to analyze predictors of poor outcome in septic shock.

Methods

The study was carried out in the Pediatric Intensive Care Unit of the Department of Pediatrics at a Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India. It was a prospective, observational study done in a time period of 10 months.

A written informed consent was obtained in a language well understood by the parents/guardians.

Methodology

A detailed history, general physical examination and systemic examination findings at the time of diagnosis of septic shock, were recorded on a standardized proforma.

During the study period of 10 months, total 120 cases were admitted in PICU. There were 90 cases of shock of different etiologies and of these 57 cases of septic shock were enrolled in the study. Among the enrolled patients 3 did not give consent to participate in the study, 4 patients left against medical advice and 10 patients expired during the course of the illness. Forty of 50 (40/50 = 80 %) cases enrolled in the study were discharged after recovery while 10 (10/50 = 20%) expired. All children aged 1 month – 18 years, admitted with or having developed septic shock during the course of hospital stay were included. Patients of malignancy, on immuno suppressive or chemotherapy drugs, who left the treatment in between or whose parents did not consent, were excluded.

Diagnostic criteria

- Septic Shock: Sepsis plus cardiovascular organ dysfunction as described below.[11]
- Despite >40ml/kg of isotonic intravenous fluid in one hour:
- Hypotension of blood pressure less than fifth percentile for age or systolic blood pressure less than two SD below normal for age, or
- Need for vasoactive drug to maintain blood pressure, or

Any two of the following:

- Unexplained metabolic acidosis: base deficit > 5mEq/L.
- Increased arterial lactate > two times upper limit of normal

- Oliguria: urine output < 0.5mL/kg/hour.
- Prolonged capillary refill time: > five seconds.
- Core to peripheral temperature gap > 3° C (5.4° F).

Systemic Inflammatory Response Syndrome (SIRS):

Two of four criteria, one of which must be abnormal temperature or abnormal leukocyte count [11]

1. Core temperature > 38.5oC (101.3oF) or < 36Oc (96.8oF) (rectal, bladder, oral or central catheter)

2. Tachycardia: Mean Heart Rate > two SD above the normal for age in absence of external stimuli, chronic drugs or painful stimuli, or

Unexplained persistent elevation of heart rate over 0.5 - 4hr, or

In children less than one-year old, persistent bradycardia over 0.5hr (mean heart rate less than tenth percentile for age in absence of vagal stimuli, beta blockers, congenital heart diseases).

3. Respiratory Rate more than two SD above normal for age or acute need for mechanical ventilation no related to neuromuscular disease or general anesthesia.

4. Leukocyte count elevated or depressed for age (not secondary to chemotherapy) or more than 10% immature neutrophils.

Sepsis: SIRS in the presence of or as a result of suspected or proven infection11

Refractory Septic Shock: Septic shock which lasts for more than one hour and does not respond to fluid or pressor administration [11]

Multi Organ Dysfunction Syndrome (MODS):

MODS is defined as a clinical syndrome characterized by the development of progressive and potentially reversible physiologic dysfunction in two or more organs or organ systems that is induced by a variety of acute insults, including sepsis and homeostasis cannot be maintained without intervention. [11]

Outcome was defined on the basis of survival. The patients who completely recovered from septic shock and got discharged uneventfully, were categorized as survivors while those who expired during the treatment were categorized as non-survivors.

Results

Table 1: Clinical symptoms as a predictor of outcome

Characteristic	Expiry (n=10)	Discharge (n=40)	P value
Fever	10 (100%)	40 (100%)	-
Altered mental status	2 (20%)	16 (40%)	p=0.750
Breathlessness	8 (80%)	24 (60%)	p=0.140
Abdominal pain	4 (40%)	18 (45%)	p=0.710
Decreased urine output	2 (20%)	10 (25%)	p=0.660
Bleeding	1 (10%)	4 (10%)	p=1.000

On analysis of clinical symptoms as predictors of outcome, fever was the most common symptom present in all the patients. Details of other parameters and their association with the outcome are mentioned in Table 1.

Table 2: Vital parameters as a predictor of outcome

Characteristic	Expiry (n=10)	Discharge (n=40)	P value
Heart rate			
Below normal	0 (0%)	0 (0%)	P=0.780
Normal	0 (0%)	10 (25%)	
Above normal	10 (100%)	30 (75%)	
Blood pressure			
Below normal	10 (100%)	36 (90%)	P=0.001
Normal	0 (0%)	4 (10%)	
Above normal	0 (0%)	0 (0%)	
Respiratory Rate			
Below normal	0 (0%)	0 (0%)	P=0.001
Normal	0 (0%)	2 (5%)	
Above normal	10 (100%)	38 (95%)	
Temperature			
Below normal	0 (0%)	0 (0%)	P=0.001
Normal	3 (30%)	10 (30%)	
Above normal	7 (70%)	30 (70%)	
Capillary refill time			
Normal	0 (0%)	18(45%)	P=0.007
Delayed CRT	10 (100%)	22 (55%)	

On analysis of the vital parameters, a delayed capillary refill time (>3 seconds) was a statistically significant (p=0.007) predictor of poor outcome with all the 10 patients having failed to survive, having a prolonged CRT on admission. Statistical association of the other vital parameters with outcome is shown in Table 2.

Table 3: Arterial Blood gas parameters as a predictor of outcome (n=50)

Characteristic	Expiry (n=10)	Discharge (n=40)	P value
Mean pH+SD	7.15+0.09	7.20+0.08	p=0.007
Mean pO2+SD	88.60+22.70	125.75+67.33	p=0.120
Mean pCO2+SD	42.08+9.26	35.26+11.23	p=0.100
Mean HCO3 +SD	16.84+3.50	19.05+4.61	p=0.198

Amongst the laboratory predictors, a low mean pH (Table 3) on admission had a statistically significant (p=0.007) association with a poor outcome.

Discussion

Sepsis is an important cause of morbidity and mortality in children. Hence, it is important to identify sepsis in the early stages to prevent its progress.

In present study, 40 patients got discharged after completion of treatment and 10 expired during hospital stay. Out of these 50 cases, 40 (40/50 = 80%) were discharged after recovery and 10 (10/50 = 20%) expired. The mortality rate in different series has shown a considerable variability. Khan et al reported a series of severe sepsis and septic shock cases with mortality rate of 24%, although the septic shock patients were studied for a time frame of 2 years. [12] Ghimire et al in their series reported mortality rate as 25.53%. [13]

Pediatric Risk of Mortality scoring is a reliable prognostic marker for prediction of mortality in children admitted to PICU. The scoring system is adopted in many Indian PICU settings irrespective of diagnosis at admission. However, studies

have raised the concern of poor validity of the scoring in children with sepsis from developing country. [14]

There was no significant association of presenting symptoms between survivors and non-survivors. However, fever was the most common presenting symptom in both the groups followed by breathlessness. In another study, Kurade and Dhanawade in their study reported fever as the most common presenting symptom and predictor of mortality associated with sepsis. [15]

This study hence proves that delayed CRT is an important indicator of peripheral perfusion, thus confirming the diagnosis of shock and its early recognition and management is an important predictor of mortality. Amongst the different vital parameters studied between the two groups significant statistical association was observed for delayed capillary refill time only. Ghimire et al. on the other hand recognized PRISM III scores as the predictor of mortality among these children. [13]

The factors associated with mortality were low SBP, high 24-hr heart rate, low GCS scores at admission, SpO2 and urine output at 24 hr and high capillary refilling time at 24 hr. Inotropic need was also significantly higher in non-survivors as compared to that in survivors, in their study. Vasundhara et al assessed clinical parameters and immediate outcome of children with shock in a tertiary care hospital in Andhra Pradesh. [16] Among 75 children with shock, 74.66% children survived, and 25.33% children died.

There was no significant association between the different laboratory and biochemical parameters between the two groups. Kurade and Dhanawade in their series identified leucopenia as a predictor of mortality. [15] In the present study, acidosis (low arterial pH) had a significant statistical association with poor outcome of septic shock. Kellum in his study discussed that acidosis may be a result of the underlying pathophysiology (e.g. respiratory failure, shock, renal failure) or may also result from the way critically ill patients are managed. Understanding the effects of acid-base on the inflammatory response is relevant as all forms of metabolic acidosis appear to be associated with prolonged hospital and ICU length of stay. [17,18]

Conclusion

A delayed capillary refill time on admission and a low mean pH were statistically significant predictors of mortality in septic shock, in this study. Sepsis in Indian children is associated with high mortality. The multiorgan dysfunction syndrome, high PRISM score and need for multiple inotropes, deranged hematological and biochemical variables are important risk factors for mortality in combination although we are yet to identify a single independent predictor for overall mortality. However, larger multicenter prospective studies should be done on the basis of new sepsis definitions and clinical practice guidelines to evaluate the true burden and outcome of sepsis in the developing countries.

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