Pediatrics & Therapeutics
ISSN: 2161-0665

Benamer,et al.,jb Pediat Therapeut 2015, 5:4
DOI: 10.4172/2161-0665.1000267

Research Article Open Access

Diagnosis, Management and Outcome of Sepsis at Benghazi Children Hospital (1 Year Review)

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Abstract

Background: Sepsis is a systemic inflammatory response to infection, and it comprise a spectrum of disorders that result from infection.

Objective: To illustrate our local experience with sepsis.

Patients: All patients (age more than one month) who admitted to Benghazi children hospital diagnosed as sepsis.

Sitting: All medical departments of the hospital except nursery. Study period: From January to December 2013.

Study design: Retrospective observational study.

Method: Data collected from admission files and analyzed.

Results: Total number of patients included was 58, 42 (72%) patients fulfilled the diagnostic criteria for sepsis and 16 (28%) wasn't. We studied the 42 patients who diagnosis of sepsis justified, 52% were males and 48% were females. Duration of admissions ranges from 5 to 34 days with a mean of 11 days. Age distribution showed that 54% of cases were 6 months or less and 76% of patients below one year. There were seasonal variation in admissions 40% of admissions in winter, 31% in spring, 20% autumn and 9% in summer. Most common complaints were fever (88%), cough (38%), diarrhea (35%), and vomiting (28%). The most common causative organism according to blood culture results were streptococci (47%) then *E. coli* (26%). 5 patients (12%) diagnosis was sepsis without clear underlying cause and 37 (88%) with defining cause, the most common presentation was pneumonia and gastroenteritis (19%) each. 64% of patients received a combination of antibiotics. 7 patients (17%) died.

Conclusion and recommendation: Twenty eight percent of our patients who treated as sepsis were not fulfilled the diagnostic criteria for sepsis. The overall outcome was intermediate. But unreliable blood culture results expose our patients to the risk of combined antibiotics therapy increasing side effect and drug resistant. We recommend application of sepsis diagnostic criteria and to limit overuse of combination of antibiotics.

Keywords: Sepsis; Antibiotics; Infection

Abbreviation: SIRS: Systemic Inflammatory Response Syndrome

Introduction

Pediatric sepsis, like sepsis in adults considers to comprise a spectrum of disorders that result from infection by bacteria, viruses, fungi, parasites or their toxins [1]. The terms bacteremia, viremia, fungemia, and parasitemia refer to bloodstream invasions that may be associated with fever but have no other signs or symptoms of circulatory compromise or end-organ malperfusion or dysfunction [2]. At 1992 to help in diagnosis and early starting of treatment Sepsis is defined as a systemic inflammatory response arising from infection, leading to widespread tissue injury and manifested by two or more of the following conditions [3,4] (Table 1).

Severe sepsis

Severe sepsis is defined as sepsis associated with hypotension or signs of hypo perfusion - at least one acute organ dysfunction, such as metabolic acidosis, acute altered mental status, Oliguria or Adult respiratory distress syndrome (ARDS), significant edema and hyperglycemia [5-7].

Septic shock

Sepsis with hypotension despite correct intake of fluid.

Refractory septic shock

Septic shock that lasts more than one hour and unresponsive to the administration of vasopressors. An example of toxic shock syndrome is staphylococcal toxic shock, whose etiology is an exotoxin synthesized by *S. aureus* [8,9].

Sepsis presents a diagnostic and management challenge to those who care for infants and children; however, early recognition and intervention clearly improves the outcome for infants and children with infections or intoxications that lead to sepsis [10,11]. Mortality from pediatric sepsis ranges from 9% to 35%. Different insults are associated with different outcomes. Host immune status is important in determining outcome. Aggressive fluid resuscitation early in the course of SIRS and proper antibiotic treatment results in decreased mortality [12,13].

This study conducted to illustrate our local experience with sepsis regarding clinical presentation, etiology, investigation, management and outcome of sepsis.

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Received September 13, 2015; **Accepted** October 28, 2015; **Published** October 30, 2015

Citation: Benamer HM, Alsaiti AA, Bofarraj M, Abud H, Tip RM (2015) Diagnosis, Management and Outcome of Sepsis at Benghazi Children Hospital (1 Year Review). Pediat Therapeut 5: 267. doi:10.4172/2161-0665.1000267

Hyperthermia	Temperature greater than 38°C [100.4°F]
Hypothermia	Temperature less than 36°C [96.8°F]
Tachycardia	Heart rate greater than 90 beats per minute in adults
Tachypnea	Respiratory rate greater than 20 breaths per minute in adults
Hyperventilation	The partial pressure of carbon dioxide [$PaCO_2$] less than 32 mm Hg
Leukocytosis	Leukocyte count greater than 12,000 cells per mm^3
Leukopenia	Leukocyte count less than 4,000 cells per mm3

Table 1: Diagnosis.

Patients and Method

Patients: All patients more than one month old admitted to Benghazi children hospital treated as sepsis in the period between January first to end of December 2013, patients who were not fulfilled the diagnostic criteria for sepsis excluded from the study.

Sitting: All medical departments of Benghazi children's hospital except nursery.

Study period: From January first, 2013 to end of December 2013.

Study design: Retrospective case series observational study.

Source of data: Medical record of clinically suspected septic patients collected from admitting files regarding: personal information, history, examination finding, applicability of sepsis diagnostic criteria, investigation results (CBC, ESR, CRP, Blood C/S, CXR, Urine examination, Others), treatment received, duration and outcome of admissions and any associated finding.

Data analysis: Collected data analyzed by using statistical package for social sciences (SPSS) computer program.

Statistical analysis: Descriptive analysis including proportion.

Results

The total number of patients treated as sepsis during 2013 were 58, 42 (72%) were fulfilled the diagnostic criteria for sepsis. 16 (28%) were not. We studied the patients who fulfilled the diagnostic criteria for sepsis, among them, 22 (52%) were males and 20 (48%) were females. Duration of admissions ranges from 5 to 34 days with a mean of 11 days. Age distribution showed that 23 (54%) of cases were 6 months or less, 32 (76%) below one year (Figure 1). Seasonal variation of admissions revealed that 40% of them admitted in winter where 31%, 20% and 9% admitted in spring, autumn, and summer respectively. The most common observed complain of study cases were fever (88%), cough (38%), diarrhoea (35%) and vomiting (28%).

The clinical profile of the studied group at admission shown in Table 2. The results of laboratory investigations of study cases shown in Table 3. The observed cultures of the studied samples shown in Table 4.

Blood cultures were available in 38 patients (90%), of which cultures were positive in 19 patients (50%), 11 patients (29%) show no growth and 8 patients (21%) found contaminated samples. The most common causative organism according to blood culture results are streptococci (47%), *E. coli* 26%. Frequency of causative organisms according to blood culture shown in Figure 2. Five (12%) patients diagnosed as sepsis alone and 37 (88%) patients accompanied by other diagnosis as shown in Table 5. All study patients received antibiotic, 64% received a combination of antibiotics, the most common antibiotics used present in Table 6. Of the total patients, 7 (17%) died.

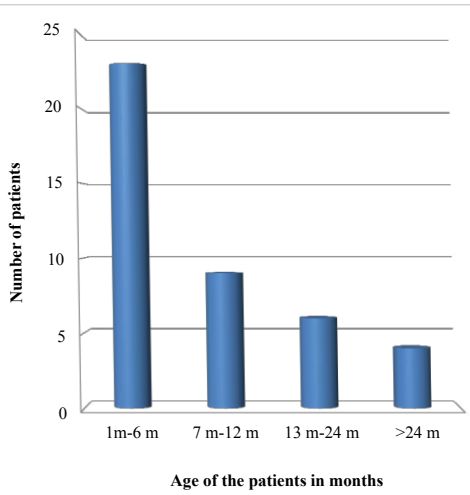

Figure 1: Age distribution of septic patients

Examination	Normal	Abnormal
Temperature	4 pt (10%)	Hyperthermia: 33 pt (87%); Hypothermia: 5 pt (13%)
Respiratory rate	7 pt (17%)	Tachypnea: 35 pt (83%)
Heart rate	31 pt (74%)	Tachycardia: 11 pt (26%)
Hepatosplenomegaly	40 pt –ve (95%)	2 pt +ve (5%)

Pt: Patient. Hyperthermia: rectal temperature >38°C, hypothermia: rectal temperature<=36°C
Normal temperature: rectal temperature >36°C and up to 38°C.
Tachypnea: Respiratory Rate (RR) >40 /minute between 2 months to 2 years of age,
>30 /minute between 2 years to 6 years, > 25/min at age of 6 year to 10 years, >20 /minute after 10 years age.
Tachycardia: heart rate >160/min in infancy, >120/min in preschool children, >110 in school age children.

Table 2: Distribution of clinical profile among septic patients.

Investigation	Available	Normal	Increased	Decreased	No result
TLC	100% (42)	40% (17/42)	50% (21/42)	10% (4/42)	0
HB	100% (42)	60% (25/42)		40% ((17/42)	0
Platelet count	100% (42)	48% (20/42)	38% (16/42)	14% (6)	0
ESR	67% (28/42)	60% (17/28)	40% (11/28)	_	33% (14/42)
CRP	43% (18/42)	44% (8/18)	55% (10/18)	_	57% (24/42)
RFT	100% (42)	78% (33/42)	22% (9/42)	_	0
LFT	50% (21/42)	57% (12/21)	43% (9/21)	_	50% (21/42)
Ca	60% (25/42)	84% (21/25)	--	16% (4/25)	40% (17/42)

The source of normal and abnormal haematological values definition according to age taken from haematology reference ranges web site: WWW.pubinfo.vcu.edu.
TLC: Total Leukocyte Count; HB: Hemoglobin; ESR: Erythrocyte Sedimentation Rate; CRP: C-Reactive Protein; RFT: Renal Function Test; LFT: Liver Function Test; Ca: Calcium.

Table 3: Distribution of investigation results of septic patients.

Cultures	Available	-ve	+ve	Contaminated	No result
Urine examination	74% (31/42)	90% (28/31)	10% (3/31)		26% (11/42)
CSF Examination	88% (37/42)	92% (34/37)	8% (3/37) Meningitis		12% (5/42)
Blood culture	90% (38/42)	29% (11/38)	50% (19/38)	21% (8/38)	10% (4/42)
CSF: Cerebrospinal fluid					

Table 4: Distribution of cultures results of septic patients.

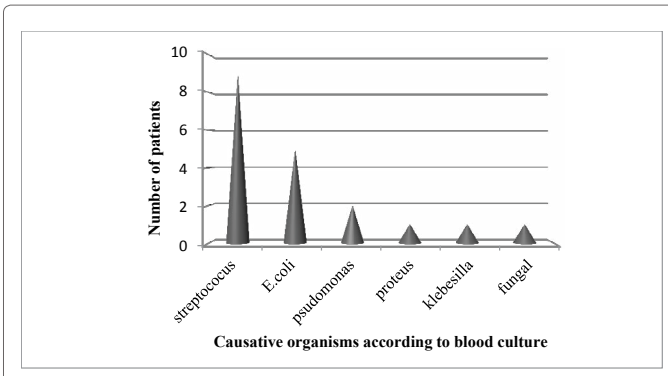

Figure 2: Frequency of causative organisms according to blood culture.

Diagnosis	Number of patients	%
Sepsis alone	5	12
+ Pneumonia	8	19
+ GE	8	19
+ Bronchiolitis	4	7.1
+ Convulsion	6	14.2
+ Meningitis	4	7.1
+ CHD	4	10
+ UTI	3	2.3
+ HIV	1	2.3
+ Neimen pick syndrome	1	2.3
+ Down syndrome	1	2.3
+ C P	1	2.3
Total		46
Total number of diagnosis = 46. Because some patients counted more than once because they have multiple problems. GE: Gastro Enteritis; CHD: Congenital Heart Disease; UTI: Urinary Tract Infection; HIV: Human Immune Deficiency Virus.		

Table 5: Frequency of accompanying diagnosis of septic patients.

Discussion

Sepsis was the sixth leading cause of hospitalization in the United States in 2009 and became the most expensive disease treated, with an annual expenditure of $15.4 billion. Sepsis is not a reportable disease, and it is possible that many deaths attributed to other diseases are actually a result of sepsis [14]. At 2004 report of French doctors Dr. Pierre Tattevin and his staff found that severe sepsis was responsible for 7% of all deaths under 16 in 2003 in France [15].

In the current study, 28% of our patients who treated as sepsis were not fulfilled the diagnostic criteria for sepsis indicating over diagnosis of sepsis. The results of our study similar to other studies in some aspects and differ in others.

Regarding age in the present study, 76% of Children under 12 months of age as the number of cases of sepsis is inversely proportional to the age that in agreement with litterateur [16,17]. The risk of contracting bacterial infection is higher in young children because they are deficient in immunoglobulin G, antibodies to encapsulated bacteria, macrophage function is insufficient and reduced neutrophil activity [18].

Antibiotic	Number of pt	%
3rd generation cephalosporin	15	36%
3rd generation cephalosporin; +gentamycin	11	26%
Ampicillin+gentamycin	9	21%
Started with Ampicillin+ gentamycin or 3rd generation cephalosporin and changed to other antibiotic	7	17%
Total	42	

Table 6: Antibiotic management of septic patients.

We observe that sepsis is slightly higher in males than females, which similar to other reports) [18-20]. These findings may suggest that the sex-related differences in immunity and infection related outcome in comparison with adult and animal studies [21-23].

In accordance with other reports the general investigations were similar [24]. In the present study the results of blood culture for causative organisms had portrayed a contrary picture were showed streptococcal species, *E. coli* and no staphylococcal aurous, we have no explanation for this observed difference from the literature as gram-positive bacteria, most commonly staphylococci, are thought to cause more than 50% of cases of sepsis [25], While in United states Multi drug-resistant pathogens, such as *S. aureus*, now account for more than half of all sepsis cases. *S. aureus* is singly responsible for 40% of ventilator-associated pneumonia episodes and most cases of nosocomial pneumonia in the United States [26,27]. No case of *H. influenza* positive blood culture in the current study that in agreement with other study [28], which is may be due to conjugate Hib vaccination implementation has essentially eliminated disease caused by *H. influenza* type B in our centers [29].

There is a problem in our hospital regarding use of blood culture as tool for farther management guide line of sepsis where 10% was not done. Of those blood culture was done 21% were contaminated samples. Also when it is positive they didn't specify (e.g.: streptococcal species), also no change in antibiotic use after blood culture result in most of the cases.

Regarding antibiotic use 64% of our patients received combination of antibiotics which not advised because the goal of antibiotics use should be to find a single, narrow-spectrum antibiotic that will control the infection [30,31]. It has been found that combining a beta-lactam antibiotic (e.g., penicillins, cephalosporins) with an aminoglycoside (e.g., gentamycin) was no more effective in reducing mortality than using the beta-lactam agent alone. In addition, the combination carries an increased risk of renal damage [30,31]. Supportive therapy has very important rule as declared in 2003 by critical care and infectious disease experts representing 11 international organizations developed management guidelines for supportive therapy in sepsis which improve the outcome in severe sepsis [32].

The overall mortality was intermediate (17%) comparing to international results (9%-35%) [13,33-37]. But higher than the study carried by Watson. RS, Joseph. A, Walter T.et (2003) reported that (10.3%) of children with severe sepsis died [18].

Conclusion and Recommendation

Twenty eight percent of our patients who treated as sepsis was not fulfilled the diagnostic criteria for sepsis and approximately two third of our patients received antibiotic combination. The overall outcome was intermediate. Unreliable results of blood culture were observed. We recommend application of sepsis diagnostic criteria to avoid over treatment and to limit over use of a combination of antibiotics which increase the side effect and drug resistant. Moreover, special attention and care during handling of blood culture samples to avoid sample contamination. Recent and impending developments in the healthcare of children may affect pediatric severe sepsis. Large discharge databases should be used with other approaches to follow its epidemiology overtime.

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