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Discrepancy between Stool Culture and Blood Culture in Acute Diarrheal Disease

Hosny Mohammed Ahmed Elmasry, Alaa Hashim, Amira Rifaat Ebrahim*
Pediatric Department, Faculty of Medicine, Al-Azhar University, Assiut, Egypt
***Corresponding author:** Amira Rifaat Ebrahim, **Mobile:** (+20) 01003011761, **E-Mail:** mdamehab411@gmail.com

ABSTRACT

Background: Acute diarrhea is defined as the passage of stools with abnormal consistency and frequency in a day (e.g. more than three times) which lasts for less than two weeks. Diarrheal diseases are reported as the leading cause of mortality among children aged five years and below. Stool or blood culture tests are very important to determine proper management for diarrheal illness.

Objective: to investigate the difference between the role of stool and blood cultures in the diagnosis of acute diarrheal disease and to determine the predictors of positive cultures in patients with diarrheal illness.

Subjects and Methods: This prospective cohort study included 77 children. Forty-one of them were males and 36 were female**s** with acute diarrhea with ages between 6months to 5 years who attending Al-Azhar Assiut University Hospital starting from May 2018 until May 2019. **Results:** The results of the present study demonstrated that Stool culture was positive in 41 cases and blood culture was positive in 8 cases. All cases with positive blood culture were also had a positive stool culture. Twenty-one cases were positive for campylobacter in stool culture and 2 cases of them were pseudomonas positive in blood culture. Twelve cases were salmonella positive in stool culture and 2 cases of them were pseudomonas positive in blood culture. Seven cases were E-coli positive in stool culture and 2 cases of them were E-coli positive and 1cases was positive for pseudomonas in blood culture. **Conclusion:** The results of this study revealed that stool or blood culture tests are very important to determine proper management for diarrheal illness, Stool culture is more sensitive than blood culture and in severely ill patients, blood culture was required.

Keywords: Acute Diarrhea, Stool Culture, Blood Culture.

INTRODUCTION

Diarrheal disease is a major public health concern for both developed and developing countries. The diarrheal disease continues to be a significant cause of morbidity and mortality worldwide. Acute diarrhea is a leading cause of child mortality in developing countries, accounting for 1.5-2 million deaths in children under five years [(1)].

Acute diarrhea is defined as the production of three or more watery stools a day for less than 14 days. The main cause of acute diarrhea in children is infectious organisms, including viruses, bacteria, and parasites [(1, 2)]. Along with improvements in living standards and health conditions, the incidence of parasite infections has decreased, with viruses and bacteria now being predominantly responsible for acute diarrhea in children [(1, 2)]. Human rotavirus is a major causative agent of diarrhea in children, especially in those <5 years of age. However, the etiology of bacteria causing diarrhea appears to differ depending on the geographical area[(2)]. The most dangerous symptom of infectious diarrhea is dehydration, which is the direct cause of much diarrheal death. The American College of Gastroenterology recommends a routine stool culture for a patient who presents with any of the following symptoms: severe or persistent diarrhea, a temperature of 38.5°C, bloody diarrhea, or the presence of stool leukocytes, lactoferrin, or occult blood and recommends blood culture in severely ill patients, immunocompromised patients, and diarrhea with severe comorbidities.

This work aims to investigate the difference between the role of stool and blood cultures in the diagnosis of acute diarrheal disease and to determine the predictors of positive cultures among those patients.

SUBJECTS AND METHODS

This is a prospective study (cohort study) targeting all cases of acute bacterial diarrhea of either sex with age between 6months to 5 years attending Al-Azhar Assiut University Hospital, starting from May 2018 until May 2019. All patients underwent a detailed history taking including Personal history present history in the form of :the duration of diarrhea ,description of stools (frequency, amount, presence of blood or mucus),fever (duration, magnitude),vomiting (onset, amount and frequency), the amount and type of solid and liquid oral intake, clinical symptoms of dehydration should be evaluated: urine output (amount and color of urine), whether the child is active, whether the child drinks vigorously, and the date and value of the most recent weight measurement , Past history to identify comorbidities that might increase the risk or severity of acute gastroenteritis and Family history

examination was done either general examination for general appearance (activity, response to stimulation) , respiratory pattern ,eye (sunken or not),Skin turgor is assessed by pinching a small skin fold on the lateral abdominal wall at the level of the umbilicus, Mucous membrane moisture level, presence of tears and extremity temperature should be assessed

Investigations were done e.g.: Complete Blood Count, C- Reactive Protein, Electrolytes (Na, K& Ca), Kidney function test (urea & creatinine) Stool specimens were examined for mucus, blood and blood

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cells and Stool culture were done for all cases: Feces were collected in the acute phase of a diarrheal disease which is the specimen of choice. Feces were collected in a clean, dry container with a tight lid and not contaminated with urine, or toilet paper. Specimen containers or collection devices were labeled with the patient's full name and two additional patient identifiers, such as medical record number and date of birth. Rectal swabs were done in some cases and blood culture was done for all cases: Enough volume of blood is aspirated from veins, not arteries.

Carefully disinfect the skin before collection of the sample using an appropriate disinfectant. Collecting a contaminant-free blood sample is critical to providing a blood culture result that has clinical value. Transport the inoculated bottles and the completed blood culture request to the clinical microbiology laboratory as quickly as possible.

Ethical approval and written informed consent:

An approval of the study was obtained from Al- Azhar University academic and ethical committee. Every patient signed an informed written consent for acceptance of the operation.

Statistical analysis

The mean and standard deviation values were calculated for each group in each test. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests and showed non-parametric (not normal) distribution. Kruskal Wallis test was used to compare between more than two groups in non-related samples Mann Whitney was used comparing between two groups in non-related samples. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

RESULTS

Our study included 77 patients their mean age was 21.64 month (ranged from 6 to 59 months) and 41 (53.2%) of cases were males and 36 (46.8%) were females. The mean of their weight was 11.18Kg.

Table 1: Demographic data

	No. (n=77)	%
Sex		
Male	41	53.2
Female	36	46.8
Age (month)		
Range	6 – 59	
Mean ± SD	21.64±13.28	
Weight (kg)		
Range	4.5 – 19	
Mean ± SD	11.18±3.28	

The mean duration of diarrhea was 4.03 days with a mean frequency was 8.6 times per day. Blood was found in 36 cases (46.8%), mucous was found in 43 cases (55.8%). 34 cases (44.2%) suffered from distension and 38 cases (49.4%) suffered from vomiting. Dehydration was found in 76 cases (98.7%) and 19cases of them were grade III. About 7 cases suffered from pneumonia.

Table (2): Clinical features

	No. (n=77)	%
Duration		
Mean±SD	4.03±1.16	
Frequency		
Mean±SD	8.6±1.98	
Blood		
No	41	53.2
Yes	36	46.8
Mucous		
No	34	44.2
Yes	43	55.8
Fever		
No	0	0
Yes	77	100
Distension		
No	43	55.8
Yes	34	44.2
Vomiting		
No	39	50.6
Yes	38	49.4
Dehydration		
No	1	1.3
Yes	76	98.7
Grade of dehydration		
0	1	1.3
I	19	24.7
II	38	49.4
III	19	24.7
Others		
No	70	90.9
Pneumonia	7	9.1

All cases (8 cases) with positive blood culture were also had stool culture positive.

Twenty-one cases were campylobacter positive in stool culture and 2 cases of them were pseudomonas positive in blood culture Twelve cases were salmonella positive in stool culture and 2 cases of them were pseudomonas positive in blood culture and 7 cases were Ecoli positive in stool culture while 2 cases of them were Ecoli positive and 1 case was positive to pseudomonas in blood culture.

Stool culture is more sensitive than blood culture as summarized in Tables 3-8.

Table (3): Comparison between stool culture and blood culture

	Stool culture		P-value
	Negative (n=36)	Positive (n=41)	
Blood culture			
Negative	36(100%)	33(80.5%)	0.005**
Positive	0(0%)	8(19.5%)	

Table (4): Comparison between organism found in stool culture and blood culture

	Organism (stool culture)					P-value
	No (n=36)	Campy-lobacter (n=21)	E coli (n=7)	Salmonella (n=12)	Shigella (n=1)	
Organism (blood culture)						
No	36(100%)	19(90.5%)	4(57.1%)	9(75%)	1(100%)	0.008**
E coli	0(0%)	0(0%)	2(28.6%)	1(8.3%)	0(0%)	
Pseudomonas	0(0%)	2(9.5%)	1(14.3%)	2(16.7%)	0(0%)	

Table (5): Comparison between culture and sensitivity (C.S) found in stool culture and blood culture

	C.S (stool culture)					P-value
	No (n-36)	3rd generation cephalosporin (n=6)	Macrolids (n=27)	Penicillin (n=7)	Quinolones (n=1)	
CS (blood culture)						
No	36 (97.3%)	6 (16.22%)	23 (62.16%)	4 (10.81%)	0(0%)	
Macrolids	0(0%)	0(0%)	2(5.41%)	1(2.7%)	0(0%)	<0.001**
Amikin	0(0%)	0(0%)	2(5.41%)	2(5.41%)	1(2.7%)	

Table (6): Comparison between organisms found in stool culture and age

	Organism (stool culture)					P-value
	No (n=36)	Campylobacter (n=21)	E coli (n=7)	Salmonella (n=12)	Shigella (n=1)	
Age Mean±SD	26.39±12.94	16±8.71	11.57±3.78	20±14.52	59±0	0.001**

Table (7): Comparison between organisms found in blood culture and age

	Organism (blood culture)			P-value
	No (n=69)	E coli (n=3)	Pseudomonas (n=5)	
Age Mean±SD	23.13±13.23	9±2	8.6±1.52	0.001**

Table (8): Sensitivity & specificity of blood culture according to stool culture

	Sensitivity	Specificity	PPV	NPV	Accuracy
Blood culture	19.51	100	100	52.17	57.14

DISCUSSION

Diarrheal disease continues to be a significant cause of morbidity and mortality worldwide. Acute bacterial diarrhea is defined as the passage of stools with abnormal consistency and frequency in a day (e.g. more than three times) which lasts for less than two weeks, fever >40°C, overt fecal blood, abdominal pain, no vomiting before diarrhea onset, and high stool frequency (>10 per day). In our study the rate of diarrhea was higher in male children, 41(53.2%) than in female children, 36 (46.8 %), as reported in many previous studies **Saeed *et al.* [3], Klein *et al.* [4] Moyo *et al.* [5], Shariff *et al.* [6], Sherchand *et al.* [7]** and the ratio of male to female children affected by the diarrheal disease was distinct from that in other

studies, which found that male and female children were equally affected [8].

In stool culture, most positive samples 21 (51 % from stool culture-positive cases) were found in children from 6 to 36 months (P, 0.001).

In contrast in blood culture, the majority of positive samples 5 (62.5% from blood culture-positive cases) were found in children from 7 to 11 month, (P,0.001) as reported in **Saha *et al.* [9]**, Among the blood culture-positive cases, median, interquartile range, age of the patient was 7 months (range = 4.5-10.5 months).In stool culture, in our study Campylobacter was the most frequently detected pathogen and was found in 21cases as reported in **Pazzzglia *et al.* [10]** which found that Campylobacter is frequently described as an important cause of diarrhea in children less than 5 years of age. And in contrast to published findings for other developing countries [3,7,11]. **Saeed *et al.* [3]** reported that E. coli was the most frequently detected pathogen, in contrast to our study E.coli was detected in 17% of positive culture cases.

In our study, shigella was reported in 2.5% of positive culture cases while in other studies by **Moyo *et al.* [5], Youssef *et al.* [12]** shigella was reported in 8% of cases. In our study, Salmonella spp. was isolated from 17% of positive culture cases. In contrast to that obtained in other studies in East Africa, in Mozambique and Tanzania, where the prevalence was approximately 3 % [5, 11]. In blood culture, 8 cases were positive 5 cases were pseudomonas positive and 3 cases were E-coli positive as reported in **Saha *et al.* [9]**. The predominant gram-negative bacteria in children with diarrhea were Escherichia coli spp and Pseudomonas spp.

In our study pneumonia was present in nearly all blood culture-positive cases, these cases also were stool culture positive and presented also with severe acute malnutrition (SAM), severe sepsis as reported also in **Saha *et al.* [9]**. Several guidelines for culture testing have been published; however, the physicians' choice of performing the test is still varied. If we can predict the positivity of stool and blood culture, it will help physicians order stool or blood culture tests appropriately and determine proper management for diarrheal illness. **Cadwgan *et al.* [13]** suggested that a simple scoring system including clinical presentation and CRP might be useful in predicting the positivity of stool culture and, therefore, could help target patients who require antimicrobial therapy.

In our study also found that symptoms, hospital stay, and laboratory tests, including CRP are predictors for stool culture positivity also as reported in **Lee *et al.* [14].**

Pneumonia with diarrhea had a trend of higher rates of bacteremia especially in severely ill patients and blood culture was required.

The main limitation of the study was the small sample size and In the process of culturing bacterial pathogens, different media are required for the growth of certain bacteria and On the other hand, contamination also might be present.

CONCLUSION

Diarrheal diseases are reported as the leading cause of mortality among children aged five years and below. Stool or blood culture tests are very important to determine proper management for diarrheal illness. Stool culture is more sensitive than blood culture. It was found that symptoms, Hospital stay, and laboratory tests, including CRP, are predictors for stool culture positivity. Pneumonia with diarrhea had a trend of higher rates of bacteremia especially in severely ill patients and blood culture was required.

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