Complete Blood Count in Children with Acute Diarrhea in Samarra City, Iraq

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Abstract
Diarrhea is a complicated disease that cause morbidity and mortality in children, specially in developing countries. It's the second leading cause of death in children under 5 worldwide, killing 2.4 million a year. This study was conducted through the period from 2nd of Junary to 3rd of March for the patients admitted to Samarra hospital and health care centers in Samarra City. The overall rate of E. histolytica and bacterial infection such as E. coli infections among school children was 58.3% and 41.7% respectively. In E. histolytica, the highest rate was 19 infection among 7-10 years followed by 9 in the age groups of 10-15 and 7 infections for the age group 5-7. E. coli was 12 infections, among 7-10, and 11 among 5-7, the lowest was 2 among 10-15 years old groups. Complete blood count results shows an elevation in bold parameters among infected children compared to healthy children. Total protein and albumin values did not differ significantly between infected and healthy children. Although the globulin value did not vary significantly between children infected with Entamoeba histolytica, and non-infected children but in E. coli infected children was lower than healthy children ($P<0.01$). The table also shows significant difference of zinc concentration (µmol/L) in serum of children with E. histolytica and E. coli infected and non-infected children. Serum zinc concentration in all infected children was significantly lower than non-infected ones ($P<0.05$).

Keyword: Diarrhea, Entamoeba histolytica, Escherichia coli, Complete blood count.

1. Introduction

Diarrhea causes increased stool frequency, volume, and consistency. Infants pass stool more frequently than older children [1]. Blood and mucus in diarrheal stools define dysentery. Chronic diarrhea lasts more than 14 days and persistent diarrhea more than seven [2].

Acute diarrhea is a leading cause of dehydration in children [3, 4]. It causes watery or loose stools on a daily basis [2]. Initial symptoms include anorexia, vomiting, abdominal pain, and fever [5].

Acute diarrhea affects children under five years of their lives, especially in the first year of life [5]. The highest incidence of infection is in the developing countries. Acute diarrhea is primarily causes dehydration, electrolyte misbalance, and acidosis, and in recurrent cases and general malnutrition, the leading cause of mortality in children until age 5. [6]. According to 2004 WHO data, 1.5 million children die of acute diarrhea, mostly in low-income countries. Morbidity rate is the highest in Africa and South Asia, and mostly from India (380,600), Democratic Republic of Congo (899,000), Nigeria (151,700), Ethiopia (73,700) and Afghanistan (82,100) [7].

Entamoeba histolytica is a human parasite. It moves by a jelly-like cytoplasmic "pseudopodium" *E. histolytica* infection can be asymptomatic to severe, resulting in intestinal and/or life-threatening extra-intestinal disease. Human stools contain at 1-6 *Entamoeba* species. *E. histolytica, E. dispar, E. hartmanii, E. polecki, E. mshkoveskii and E. coli* causes disease [8, 9]. Microscopic examination is not able to differentiate *E. histolytica, E. dispar,* and *E. moshkovskii. E. histolytica* was overestimated in epidemiological surveys, causing infection reports to reach more than 50% in some endemic areas [10]. DNA analysis is able to identify pathologic amoebae in pathological samples, and *E. histolytica* prevalence is expected to be lower. *Entamoeba dispar* and *moshkovskii* can be asymptomatic to carriers [8].

E. histolytica causes traveler's diarrhea. Local endemicity of the organism increases traveler risk [11]. Food or water containing *Entamoeba histolytica* cysts causes amebic colitis and liver abscess. The trophozite usually destroys intestinal epithelium and causes symptoms. Amebic colitis usually begins subacutely with weight loss and causes bloody diarrhea. Because *E. histolytica* looks like *Entamoeba dispar*, and amebic colitis is best diagnosed by finding it in stool. Men have 10 times more amebic liver abscesses than women.

Blood cells and platelet parameters are routinely ordered in some UTI patients [12]. Platelets are multinucleated cells. They're bone marrow megakaryocytes. Platelets increase leukocyte recruitment and inhibit monocyte, neutrophil, and eosinophil apoptosis [13, 14].

2. Materials and Methods

The study was conducted through the period from January 2nd to March 3rd of for the patients admitted to Samarra hospital and health care centers in Samarra City.

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Their age ranged between 5 and 15 years old. A total of 170 stool samples of diarrhea patients were collected in plastic disposable containers and were labeled with patient's data. The sample was examined within 1 hour from collection to detect the microbe infection. The samples were first examined by (direct wet mount) method and (ether concentration techniques).

Blood samples were obtained, about 5 ml from each patient, without EDTA. The former was used for biochemical tests, and zinc concentration.

Biochemical tests: The total serum protein and albumin were measured by using kits from Randox Laboratories Ltd., U.K. The value of serum globulin was estimated by subtracting the value of serum albumin from the total protein.

Zinc level was estimated using (atomic absorption spectrophotometer-Varian, Australia) after dilution of serum samples with deionized distilled water 1:4 to bring the metal concentration within the working range of atomic absorption spectrophotometer by direct aspiration of the samples. Both Chi square and student's t-test were used in the statistical analysis.

3. Results

Out of the 170 collected samples, 60 samples were positive for infection with both *Entamoeba histolytica* and *Escherichia coli*. The overall rate of *E. histolytica* and bacterial infection such *as E. coli* infections among school children was 58.3% and 41.7% respectively. In *E. histolytica*, the highest rate was 19 infection among 7-10 years followed by 9 in the age groups of 10-15 and 7 infections for the age group 5-7. In *E.coli* was 12 infections, among 7-10, and 11 among 5-7, the lowest was 2 among 10-15 years old groups. The overall rate of both infections, was (30.0%) among 5-7 year, followed by 7-10 years (51.7%) and 10-15 years (18.3%).

Table (1): Distribution of infections according to age of children

Age (year)	Positive isolates		E. histolytica		E. coli	
	No.	%	No.	%	No.	%
5-7	18	30.0	7	38.9	11	61.0
7-10	31	51.7	19	61.3	12	38.7
10-15	11	18.3	9	81.9	2	18.2
Total	60	100.0	35	58.3	25	41.7

As it shown in Table (2), the distribution of E. histolytica and E. coli infections according to gender. In E. histolytica infection, the rate of male vs female was 38.3/20%; in E. coli 20/21.7%. Statistically there was no significant difference between gender in both infections

Table (2) Distribution of infections according to gender of children

Age (year)	No. +ve	E. histolytica No.= (35)		E. coli No.= (25)	
		Male	Female	Male	Female
5-7	18	5	2	4	7
7-10	31	12	7	6	6
10-15	11	6	3	2	0
Total	60 (100.0%)	23 (38.3%)	12 (20 %)	12 (20%)	13 (21.7%)

Among the laboratory findings in Table (3) were WBC count (white blood cells), RBC count (red blood cells), HGB count (hemoglobin), platelet count (PLT), hematocrit (HCT), mean corpuscular volume (MCV), (MCH & MCHC) concentrations, platelet distribution width (PDW), Procalcitonin (PCT), and CRP count (Table 3).

Table (3): Complete blood count results of all diabetic patients.

CBC parameters	Normal values	E. histolytica	E. coli
RBC (10^6/uL)	4.00 - 5.50	4.803 ± 0.788	4.439 ± 0.835
WBC (10^3/uL)	4.00 - 11.00	11.128 ± 3.892	12.721 ± 1.545
HGB (g/dL)	12.0 – 17.0	13.758 ± 2.092	12.90 ± 1.846
HCT (%)	37.0 – 52.0	40.642 ± 7.961	41.401 ± 1.902
MCH (pg)	26.0 – 38.0	26.354 ± 2.721	28.735 ± 0.365
MCV (fL)	80.0 – 100.0	77.068 ± 12.081	79.252 ± 10.651
MCHC (g/dL)	31.0 – 37.0	33.808 ± 1.675	33.91 ± 1.073
PLT (10^3/uL)	150 - 450	341.24 ± 81.137	381.647 ± 128.38
PDW (fL)	9.0 – 17.0	12.264 ± 2.754	15.213 ± 2.713
MPV (fL)	9.0 – 13.0	9.10 ± 1.345	9.523 ± 1.196
PCT (%)	0.17 – 0.35	0.603 ± 0.173	30.588 ± 0.148
CRP (mg/L)	> 10 mg/L	27.16 ± 15.581	15.31 ± 1.665

Table (4) shows the studied parameters among infected and non-infected children. Total protein and albumin values did not differ significantly between infected and non-infected children. Although the globulin value did not vary significantly between children infected with *Entamoeba histolytica*, and non-infected children but in *E. coli* infected children was lower than non-infected children (P<0.01). The table also shows significant difference of zinc concentration (µmol/L) in serum of children with *E. histolytica* and *E. coli* infected and non-infected children. Serum zinc concentration in all infected children was significantly lower than non-infected ones (P<0.05).

Table (4): Biochemical parameters among E. histolytica and E. coli infected children Mean± S.D

Parameters	E. histolytica		E. coli		P-value
	Infected	Non-infected	Infected	Non-infected	
Total Protein	5.37±1.47	5.30±0.74	5.31±0.97	5.60±1.40	0.5200
Albumin	3.60±0.80	3.64±1.24	3.17±1.54	3.49±1.57	0.1020
Zinc (µmol/L)	9.5±0.75	15.70±0.95	10.50±1.30	17.5±1.09	0.001*
*significant					

4. Discussion

The overall rate of *E. histolytica* and E. coli among 170 children aged from 5-15 years old were 35.3 % This reflects that protozoan and bacterial infections are common in Samarra City. Salman et al. examined 266 found the total rate of infection was 64.28% in 171 stool samples, and it was mostly E. histolytica 94 (34.21%). [15] examined 94 and found 25.53% E. coli. Local previous studies recorded in [16] Elkord et al. [17], and Pimpunchat et al. [18] were 24%, 30%, and 52.54% respectively,

These infections are endemic worldwide and are a public health problem specially in tropical and subtropical

countries [19]. Comparing the rate of infections with those from different parts of the country and neighboring countries, showed a considerable difference could be found in prevalence of infections. The differences can be explained by the influence of level of sanitation, environmental conditions, human behavior, laboratory diagnosis used for detection of infections and health education among school children [20].

There is a persistent danger of transmission in a community of asymptomatic carriers of these illnesses by fecal oral transfer, either directly or indirectly via eating or drinking food or water that has been infected with these bacteria [16].

The highest rate was 19 infection of E. histolytica among 7-10 years followed by 9 in the age groups of 10-15 and 7 infections for the age group 5-7. In E. coli was 12 infections, among 7-10, and 11 among 5-7, the lowest was 2 among 10-15 years old groups. The overall rate of both infections, was (30.0%) among 5-7 year, followed by 7-10 years (51.7%) and 10-15 years (18.3%). There were no significant difference between infected and non-infected ones in relation to age group. This finding is almost identical to that reported by Hussein et al., in Baghdad City, who reported that the rate of intestinal parasites among children was 57.9%., the highest prevalence (71.4%) was mostly among 6-11 years age group followed by age group 12-18 years (55.1%), while the group below than 2 were the less affected group (30.6%) [16]. In [21] examined 1261 stool specimens of children, the age group 10-12 years had the highest rate (81.2%) and 7-9 years the lowest (22.9%).

Regarding the distribution of infections according to gender, although the rate of both infection in males were greater than females, but statistically there was no significant difference between sexes. In Baghdad City, it has been reported that there was none-significant difference between gender and infectivity rate of E. histolytica and G. lamblia in children aging from 1 month to 2 years [15]. In Kirkuk [19] examined 943 stool samples of children attended Kirkuk Pediatric hospital, she found the infection with E. histolytica/E.diapar was 30.22%, the highest rate was among 5-6 years (43.96%). Infection rate among illiterate children was higher than educated ones.

Cases demonstrated greater levels of white blood cells, red blood cells, hemoglobins, platelets, and hematocrit (HCT, MCV, MCH, MCHC) concentrations and platelet distribution width (PDW), Procalcitonin (PCT), and C-reactive protein (CRP) counts than the usual ranges. The increase in white blood cells during protozoal infections is also reported in B. hominis infection [22].

phagocytosis, which protects the body from invasion by foreign organisms, is the primary role of white blood cells in the immune response. They also create or at least transport and distribute antibodies. In this study the white blood cells count was higher among infected children than non-infected ones. This finding is also reported in other study in Baghdad [15] in G. lamblia and E. histolytica [22].

Proteins abound in the serum of the blood. Albumin and globulin are two of the most common proteins in blood serum. In a total serum protein test, albumin and globulin levels are also taken into consideration. Because albumin and globulin are included in the total protein. Knowing which protein fraction is higher or lower than the total protein is critical information. There was no difference in the serum total protein and albumin values between infected and non-infected children in this investigation, as previously reported. Similar finding is reported by Kadir et al. [23] in B. hominis infection. Decrease albumin may also be explained by malnutrition or a low protein diet. As for zinc, the results showed The table also shows significant difference of zinc concentration (µmol/L) in serum of children with E. histolytica and E. coli infected and non-infected children. Serum zinc concentration in all infected children was significantly lower than non-infected ones.

Several biochemical, immunological, and clinical illnesses require the trace metal zinc. Lack of animal protein, excessive phytate in the diet, and increased fecal losses during diarrhea are all factors that contribute to zinc deficiency [23]. In line with [24], who found a drop in zinc levels in the serum of children aged 6 years and older who had diarrhea, the zinc concentration in infected children was lower than in non-infected children.

A total of 117 children aged six to fifty-nine months were studied to see if daily zinc supplementation affected the clinical onset of acute diarrhea, that is, the frequency of stool, the amount of stool, and the interval of acute diarrhea. One study indicated that supplementing with zinc reduced stool frequency by 62%, whereas the placebo-supplemented group saw a 26% drop. These results show a significant difference of 36% between the two groups from days 1 to 3 and 5, respectively. Similarly, there was a clear 45 percent difference between the study groups for the reduction in daily stool volume from day one to day three and day five Using a meta-analysis of 12 studies, researchers found that zinc supplementation can reduce the length of an acute diarrheal episode. There was a significant decrease in eight of the cases. Zinc supplementation were found to reduce the volume and frequency of stool production in five of these studies. When it came to treating acute diarrhea, zinc supplementation was found to have a significant and favorable effect on both the length and intensity of symptoms.

5. Conclusions

Diarrhea is a common infection among school children and it prevelenc is relatively high in Samarrah City. There is no significant differences regarding age and sex but it appears that the infection by protozoab and bacterial agents affects the biological markers in the human blood. Low zinc level is a significant marker of sever diarrheal infection compared to non-infected cases.

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