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INTESTINAL PARASITES IN CHILDREN RECEIVING CHEMOTHERAPY

By

HANAA AHMED EL-HADY[1], NOHA SAMMER AHMED[1*], MOHAMED AHMED ALI TAHA[2], NASSER MOHAMED ABD EL-KAREEM[2] AND RAFAAT ABDELAAL BAKHEET[3]

Department of Medical Parasitology[1], Faculty of Medicine, Sohag University, Department of Medical Parasitology[2], Faculty of Medicine, Al Azhar University, and Department of Oncology[3], Faculty of Medicine, Sohag University, Egypt.
(*Correspondence: nohasammer@yahoo.com)

Abstract

Serious complications associated with some parasitic diseases in immunosuppressed patients. An extreme course might be connected with noteworthy morbidity and mortal sin in children having intestinal parasitic infections and getting chemotherapy for management from threatening tumors. This study pointed at figuring out the prevalence and type of intestinal parasites over stool specimens of children receiving chemotherapy contrasted with healthy children. A cross-sectional survey was calculated among 100 children receiving chemotherapy in Sohag Oncology Institute and 100 apparently healthy children as a control group. Stool examination by direct method and concentration by formol-ether sedimentation, then staining with Kinyoun's modified acid-fast stain were done. Among those children receiving chemotherapy, 94% were diagnosed positive for parasitic infections, in contrast to 35% in the control group. Parasites that were detected in children receiving chemotherapy and healthy control group respectively were *Cryptosporidium* sp.(45% vs.10%), *Giardia lamblia* (19% vs. 7%), *Entamoeba histolytica* (14% vs. 4%). Statistically significant differences in these parasitic infections were detected between the two studied groups (p-value < 0.001), while infections with *Entamoeba coli* (12% vs. 4%), *Hymenolepis nana* (4% vs. 4%), *Schistosoma mansoni* (0% to 2%) were statistically not significant. Parasitic infection is common among children receiving chemotherapy. In order to get the suitable management clinicians treating children receiving chemotherapy should make mindful about these infections.

Keywords: Children, Chemotherapy, *Cryptosporidium* sp., *Giardia lamblia*, *Entamoeba histolytica*.

Introduction

Children with cancer often have gastrointestinal and liver symptoms. Risk factors include neoplastic infiltration, mechanical obstruction by tumor mass, abdominal tumor rupture, abdominal surgery, radiation therapy and, primarily, antineoplastic chemotherapy, with different effects according to drugs, dosing, schedule and associated treatments (Castagnola *et al*, 2016). Parasitic infections are common among children in developing countries especially the immunocompromised children (Ajjampur *et al*, 2008). The immunocompromised patient does not have the ability to react typically to the infection due to an impeded or weakened immune system. These defects in the normal defense mechanism might predispose those people to an expanded danger for severe life-threatening infections (Pizzo, 1996).

Different parasitic infections are associated with defects in the immune system (Weber *et al*, 2006). Intestinal parasites as *Cryptosporidium parvum, Cyclospora, Microspora, Isospora, Giardia lamblia* and *Strongyloides* are the most common parasites which may cause morbidity and or mortality in immunocompromised hosts (Noskin *et al*, 1997). *Cryptosporidium* species are apicomplexan parasites that infect the gastrointestinal epithelium. Infected people show a wide range of clinical presentations. However *Cryptosporidium* pathogenicity varies with the parasites species included and the type, age, further-

more, immune status of the host. They are important, widespread causes of diarrheal ailment over people and some domesticated animals (Xiao *et al*, 2004). Other types of parasites, such as *Giardia lamblia*, *Entamoeba histolytica* were also frequently detected in immunosuppressed patients (Mariam *et al*, 2008).

Giardia lamblia (syn. *G. intestinalis* or *G. duodenalis*) is a flagellated unicellular eukaryotic microorganism that commonly causes diarrheal disease worldwide. It is the most common cause of waterborne outbreaks of diarrhea in the United States (Barwick *et al*, 2000) and among travelers with chronic diarrhea (Huang and White, 2006).

Amoebiasis is initiated by the discovered worldwide protozoa, *Entamoeba histolytica*. The highest prevalence of amoebiasis was in developing countries where barriers between human feces, food and water supplies are inadequate (Grecu *et al*, 2006; Pritt and Clark, 2008). On the other hand, the relationship between suppression in the immune status in children receiving chemotherapy and intestinal parasites in Sohag Governorate, Egypt has not been studied.

This study was conducted to compare the prevalence and type of intestinal parasites in the stool specimens of children receiving chemotherapy as compared to apparently healthy children.

Subjects and Methods

Study population, ethics statement and inclusion criteria: The study population consisted of 100 children receiving chemotherapy in Sohag Oncology Institute aged 3-12 years and 100 apparently healthy cross-matched children as a control group. They were informed that the study was voluntary and their privacy would be protected. All children who agreed to participate in this study and whose parents gave a written informed consent were eligible for the study after being authorized by the scientific ethics committee of the institute.

Study design: The cross-sectional baseline survey assessed the prevalence and intensity of parasitic infection among children receiving chemotherapy to that observed in apparently healthy children.

Stool collection and parasite identification: Stool samples were collected into closed sterile labeled stool containers. All samples were subjected to stool examination by direct examination, by formol-ether sedimentation method then stained with Kinyoun'smodified acid-fast stain (Cheesbrough, 2009). Each slide was carefully examined under x40 & x100 magnification. Children were considered positive for a particular infection if at least one of the diagnostic methods revealed a positive result.

Statistical analysis: Statistical Package for Social Science (SPSS) program (version 20) was used for grouping, tabulation and statistical analysis of the data. Sample characteristics were summarized using the mean and the standard deviation (SD) for continuous variables and percentage for categorical variables. Difference in prevalence of intestinal parasites between both groups was investigated using chi-square test. P value below 0.05 was considered significant.

Results

Sociodemographic characteristics of studied participants: 200 children were enrolled in this study, including 109 boys and 91 girls, there was no significant difference between boys and girls (54.5% vs. 45.5%) respectively. Stool samples were collected from 100 children on chemotherapy at Sohag Oncology Institute as a study group aged 3 to 12 years (age=8.9±1.9) and from 100 apparently healthy children as a control group (age =10.7±0.4).

The parasites in 200 children were oocysts of *Cryptosporidium* sp. positive (27%), cysts of *Giardia lamblia* positive (13%), trophozoites and cysts *of Entamoeba coli* positive (11%), cysts of *Entamoeba histolytica* positive (9%), *Hymenolepis nana* eggs positive (4%) and *Schistosoma mansoni* positive (1%) in groups (Tab. 1).

Table 1: Sex and variable distributions of intestinal parasitic infections among samples.

Variable		No. (N = 200)	%
Sex	Boys	109	54.5%
	Girls	91	45.5%
Chemotherapy	Yes	100	50.0%
	No	100	50.0%
Cryptosporidium	Positive	55	27.0%
	Negative	145	73.0%
G. lamblia	Positive	26	13.0%
	Negative	174	87.0%
E. histolytica	Positive	18	9.0%
	Negative	182	91.0%
E. coli	Positive	22	11.0%
	Negative	178	89.0%
H. nana	Positive	8	4.0%
	Negative	192	96.0%
S . mansoni	Positive	2	1.0%
	Negative	198	99.0%

Parasitic infections in children receiving chemotherapy and controls separately: 94 children (94%) were diagnosed positive for parasitosis among children on chemotherapy, whereas 35 children (35%) were positive in control group. Parasites \detected in children receiving chemotherapy and controls respectively were *Cryptosporidium* sp. sp. (45% vs. 10%), *G. lamblia* (19% vs. 7%), *E. histolytica* (14% vs. 4%) were significant between both groups ($p < 0.001$). *E. coli* (12% vs. 4%), *H. nana* (4% vs. 4%) and *S. mansoni* (0 % vs. 2%) were without significant between both groups (Tab. 2). Distribution of parasitic infection among patients and controls was given (Fig. 1)

Table 2:Prevalence of parasitic infections between children receiving chemotherapy and control group.

Parasitic infection	Result	Chemotherapy group (N=100)		Control group (N=100)		P value
		No.	%	No.	%	
Cryptosporidium	+ ve	45	45%	10	10%	*P*<0.001*
	- ve	55	55%	90	90%	
G. lamblia cyst	+ ve	19	19%	7	7%	*P*<0.001*
	- ve	81	81%	93	93%	
E. histolytica cyst	+ ve	14	14%	4	4%	*P*<0.001*
	- ve	86	86%	96	96%	
E .coli	+ve	12	12%	10	10%	*P*=0.674
	-ve	88	88%	90	90%	
H .nana egg	+ve	4	4%	4	4%	*P*=0.155
	- ve	96	96%	96	96%	
S. mansoni egg	+ve	0	0%	2	2%	*P*=1.000
	- ve	100	100 %	98	98%	

*Statistically significant

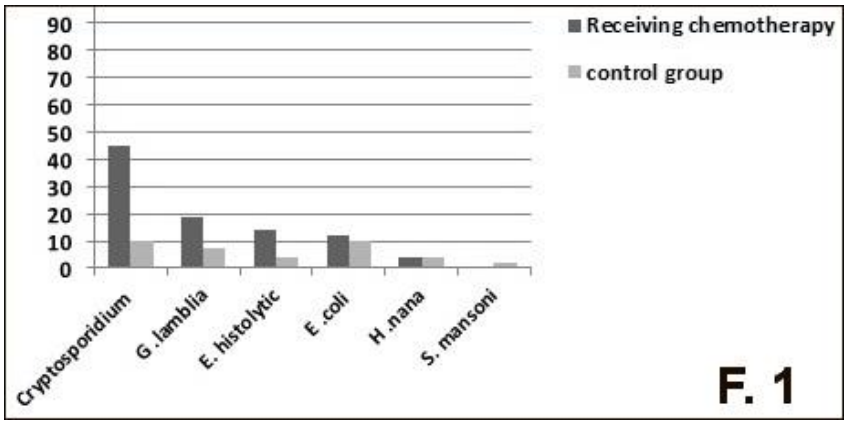

Fig. 1: Distribution of parasitic infection among children receiving chemotherapy and control group

Discussion

The intestinal parasites are the majority basic human infections distributed worldwide with high pervasiveness rates in the developing countries (Sethi *et al*, 2000). A lot of these pathogens, especially the intracellular protozoa that chiefly influence the small intestine, produce their most devastating effects in patients with immune deficiency. Parasitic infections generally are asymptomatic in otherwise healthy individuals; however, their manifestations in immunocompromised individuals were more severe and tend to produce greater pathological sequelae in these patients (Garcia, 2001).

With the increasing numbers of the immunocompromised individuals worldwide, closer examination and detection of intestinal parasitic infections in these individuals is highly needed (Kamki *et al*, 2015).

In the present study, the overall parasitic infection was 94% among the immunocompromised group and in 35% among healthy control group. This result agreed with Abdel-Hafeez *et al.* (2012) who detected 94% intestinal parasites positivity among immunosuppressed patients, and 60% among immunocompetent patients. El-Nadi and Taha (2004) also reported 94% among the immunocompromised patients had parasitic infections. But, Khalil *et al.* (1991), Abaza *et al*. (1995) and El-Diffrawy *et al*. (2002) reported parasitic infections rates of 18.9%, 23%, 48% respectively among the immunocompromised patients. The difference in parasitic prevalence may be due to multifactorial reasons as the environment and climatic conditions, sanitary practices and the different sample size and ages.

In the present study, *Cryptosporidium* was the commonest in both groups (45% vs. 10%). Establishment of some organisms may follow the reduction in the local and cell-mediated responses to intestinal parasites in immunosuppressed patients. This data agreed with Abdel-Hafeez *et al*. (2012) who found that the prevalence of cryptosporidiosis was higher in the immunosuppressed group than the immunocompetent ones (60.2% vs. 42.2%).

In the present study, both *G. lamblia* and *E. histolytica* were more prevalent in patients with immunosuppressed status than in immunocompetent status (19% vs. 7% & 14% vs. 4%) respectively, but less than *Cryptosporidium.* Some changes in the gut structure may follow infection in immunosuppressed patients, which were unsuitable for *E. histolytica* and *G. lamblia* establishment (Abdel-Hafeez *et al*, 2012). Intestinal parasites colonization might be induced by any enteropathy cause(s) that suppressed of immunity (McMurchy *et al*, 2010). Also, this may selectively determine the establishment and/or survival of extracellular and luminal parasites. In contrast, whereas the gut of immunosuppressed people might not make ideal surroundings to the establishment also or survival of extracellular parasites, mucosal staying creatures might not be adversely influenced toward those pathologic transforms (Lindo *et al*, 1998) or may be due to that the immune response in giardiasis is principally humoral and the role of cellular immunity is questionable in mankind's (Lewis *et al*, 1997). Stevenson (1987) in patients on the chemotherapy, found suppression of antibody production and avoidance of multiplication of stimulated B-cells happened. El-Nadi *and* Taha, (2004) among immunosuppressed patients found that *E. histolytica* and *G. lamblia* were 56% & 58%. Abdel-Hafeez *et al*. (2012) found that *E. histolytica* and *G. lamblia* were prevalent in patients with immunocompetent status than in immunosuppressed status (24.6% vs. 6% & 17.6% vs. 4.8%) respectively.

In the present study, *E. coli* was more prevalent in immunosuppressed patients than in immunocompetent ones (12% vs. 10%), but without significant. This agreed with Cimerman and Lewis (1999) in Brazil and Assefa *et al.* (2009) in Ethiopia who

found that *E. coli* was 13% & 12.6% respectively but more prevalent than Mohandas *et al*. (2002) in North India and Al-Megrin (2010) in Saudi Arabia who reported *E. coli* 1.7% & 3.7% respectively.

In the present study, *H. nana* prevalence was 4% in both immunosuppressed patients and controls. El Nadi and Taha (2004) found no difference in *H. nana* in both groups, but Zabolinejad *et al*. (2013) in Iran reported (1.1%) pervasiveness of *H. nana* in youngsters with malignancy. Generally, *H. nana* is transmitted by autoinfection without related to patient immunity

In the present study, *S. mansoni* was more prevalent in immunocompetent patients than in immunosuppressed status (2% vs. 0%), which might be due to the fact that the immunosuppressed children on chemotherapy did not play in the canals' water as the healthy children.

In the present study, none in both groups had *S. stercoralis*. Abdel-Hafeez et *al*. (2012) found none with *S. stercoralis*, but Mariam *et al.* (2008) found that *S. stercoralis* was 11.5%.

In the present study, none had *Microsporidia*, or *Cyclospora*, or *Isospora*. But, El-Diffrawy *et al*, (2002) found *Cyclospora* in (8%), and Baiomy *et al*, (2010) detected *Microsporidia* (2%) among the immunocompromised patients. This might be due to differences in the environment, climates social, health, and/or economic conditions.

Conclusion

The parasitic infection is common among children receiving chemotherapy. The present study highlights the importance of searching for intestinal parasites in the immunocompromised children and emphasizes the necessity awareness among clinicians regarding the occurrence of these parasites in this population and health education of the population for food hygiene. Recurrence also risk for these parasitic infection require their proficient diagnosis and proper management.

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