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Prevalence of Intestinal Protozoan Parasites in Adult Cancer Patients in Elazığ: A Cross-Sectional Study *

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Objective: Among cancer patients, immunosuppression due to the disease itself or the therapeutic agents used increases the risk of intestinal parasitic infections. The aim of the present study was to determine the types of parasites, the incidence and risk factors that might affect the treatment process and the life quality in cancer patients.

Materials and Methods: This study was carried out in Firat University Hospital and 18 years old and over oncology patients were followed up and treated. Stool specimens were taken 3 times (at least once) on different days from patients and examined primarily by native and lugol methods. Subsequently, preparations prepared by applying the formol-ether concentration method were examined by specific staining methods.

Results: Among 111 oncology patients, 43 (38.7%) were infected with one or more parasites. In 33 (29.7%) patients, a parasite was detected, whereas 7 of them (6.3%) had two species, and 1 of them (0.9%) had three species of parasites. Blastocystis sp. was the most common parasitic species in 34 (30.6%) cases. Only commensal parasites were detected in 32 (28.8%) stool specimens and commensal and pathogenic parasites were detected in 11 (9.9%) stool specimens. There was no significant difference in the distribution of parasitic infections according to demographic characteristics, disease history, personal hygiene habits, clinical status and complaints of the patients.

Conclusion: The prevalence of intestinal protozoa in our study group is higher than the prevalence detected in the normal population in our region. We think that this area needs more research, which will help clinicians and create new approaches for patients' treatment and follow-up.

Key words: *Intestinal parasites, immunocompromised patients, cancer, prevalence*

Elazığ'da Yetişkin Kanser Hastalarındaki Bağırsak Protozoan Parazitlerinin Prevalansı: Kesitsel Bir Çalışma

Amaç: Kanser hastalarında, hastalığın kendisinden veya kullanılan terapötik ajanlardan kaynaklanan immünsüpresyon, intestinal paraziter enfeksiyon riskini arttırır. Bu çalışmada, parazit türlerinin belirlenmesi, insidansı ve risk faktörlerinin belirlenmesi amaçlanmıştır.

Gereç ve Yöntem: Bu çalışma Fırat Üniversitesi Hastanesi'nde takip ve tedavi edilen 18 yaş ve üzeri onkoloji hastalarında yapıldı. Hastalardan en az bir kez olmak üzere farklı günlerde 3 kez gaita alındı. Daha sonra, formol-eter konsantrasyon yöntemi uygulanarak hazırlanan preparatlar, özel boyama yöntemleri ile incelenmiştir.

Bulgular: 111 onkoloji hastasının 43'ünde (%38.7) bir veya daha fazla parazit mevcuttu. Hastaların 33'ünde (%29.7) bir parazit türü saptanırken, 7'sinde (%6.3) iki tür, 1'inde (%0.9) üç tür parazit vardı. 34 (%30.6) olguda saptanan Blastocystis sp. en sık görülen paraziter türdü. Dışkı örneklerinin 32'sinde (%28.8) sadece kommensal parazitler, 11'inde (%9.9) kommensal ve patojenik parazitler tespit edildi. Paraziter enfeksiyonların demografik özelliklerine, hastalık öyküsüne, kişisel hijyen alışkanlıklarına, klinik durumuna ve hastaların şikayetlerine göre dağılımında anlamlı bir fark bulunamadı.

Sonuç: Çalışma grubumuzdaki intestinal protozoaların prevalansı, bölgemizdeki normal popülasyonda tespit edilen prevalanstan daha yüksek olduğu bulunmuştur. Bu alan ile ilgili klinisyenlerin hasta takibi ve tedavisi için yeni yaklaşımlar yaratmasına yardımcı olabilecek daha fazla araştırmaya ihtiyaç duyulduğunu düşünüyoruz.

Anahtar Kelimeler: *Bağırsak parazitleri, immünkompromize hastalar, kanser, prevalans*

Introduction

World Health Organization data show that parasitic infections continue to be a major health problem worldwide (1, 2). It is reported that prevalence is high in developing countries and countries with poor public health infrastructure (3, 4). Despite the improvements and training provided in the field of health in recent years, parasitic infections are still considered to be an important cause of morbidity and mortality (4-6).

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Intestinal parasites often spread through contaminated food, drinking water, as well as close contact. (1, 7, 8). The incidence of intestinal parasitic infections varies depending on environmental, economic, regional, political, cultural and social factors. In developing countries, the difficulties in accessing health care services and malnutrition increase the risk of infection (4, 9). In previous studies conducted in different regions of our country, prevalence of intestinal parasitic infection has been reported to be 4 - 22.43%. (10-15).

The host immune system is important for controlling the spread of parasites and also eliminating these infectious agents (1, 16). In many cases, the ability to successfully combat parasitic infections requires an effective inflammatory response to parasites while limiting potential tissue damage in the area (3). Some opportunistic parasitic infections in immunocompromised patients may be lead to serious and lethal complications (such as persistent diarrhea and malabsorption) (3, 4, 9).

In cancer patients, the immune system is suppressed either by the disease itself or by therapeutic agents that cause immunosuppression (17, 18). The widespread use of immunosuppressive therapies and the increase in immunosuppressed individuals increases the risk and prevalence of parasitic infections. The development of parasitic infections in these patients negatively affects the quality of life and the difficult treatment process. The prevalence of intestinal parasites varies from country to country and varies between 6.7-88.9% (1, 5, 9, 17, 19). In our country, studies on this subject are very limited and intestinal parasites were detected in 22.5% (14) of immunosuppressive patients and 30.3% (20) of child cancer patients.

Immunosuppression of both humoral and cell-mediated immunity, have different results for the host depending on its magnitude, and will alter the pattern of parasitic pathogens in which they are sensitive (3). *Cryptosporidium* and *Microsporidium* species (ssp), which are less common in immunocompetent patients and appear asymptomatic or clinically mild, are rather common in immunosuppressed patients and also bring on severe clinical symptoms (4, 16, 21). For this reason, it is extremely important to determine the prevalence and risk factors of parasitic infections in cancer patients, as it may lead to prophylactic measures in cancer patients as well as new approaches for clinicians.

In this study, we aimed to evaluate the frequency of intestinal protozoan parasites according to demographic and clinical features in cancer patients receiving chemotherapy in Elazig.

Materials and Methods

This cross-sectional study was performed in 111 oncology patients ≥18 years who were followed up and treated at the oncology service. This study was approved by the Non-Interventional Research Ethics Committee (Protocol no: 2017/14-03). All the patients included in the study signed the informed consent form.

Each patient filled out a form with demographic information. Labeled, sealed and clean plastic feces containers were sampled three times (at least one time) on different days and immediately brought to the laboratory. First, the stool specimens were examined by microscopy with native and lugol methods. Subsequently, swab preparations were prepared from the samples concentrated by the formol-ether method. These preparations were stained with Trichrome, Modified Trichrome (Weber's Trichrome), modified Ziehl-Neelsen staining methods. Fresh spread preparations stained with calcofluor white (Sigma-Aldrich, U.S.A) were also examined by adding a drop of 10% potassium hydroxide solution under blue light at 355 nm wavelength.

The data were analyzed through the chi-square test in SPSS 22 statistical package program. A value of $P<0.05$ was considered statistically significant.

Results

73 female patients were aged between 27-80 (54±13) years and 38 male patients were aged between 29-79 years (59±12). Forty-three of the patients (38.7%) were infected with one or more parasites. At least one parasite species was detected in 43 patients (38.7%), while two or more species were detected in 10 patients. (9.0%). The most common parasitic type was *Blastocystis sp.* in 34 (30.6%) cases. The distribution of the parasite species detected in stool specimens is presented in Table 1.

No statistically significant difference was found in the distribution of parasitic infections according to the demographic characteristics, disease history, personal hygiene habits, clinical status and complaints of the patients (Table 2, 3 and 4). Patients' body mass index (BMI) was calculated according to the formula weight/height^2 (kg/m²) and patients were classified as weak (<18.5), normal (18.5-24.9), overweight (25-29.9) and obese (30 and over). When the distribution of parasitic infections was evaluated according to the BMI of the patients, no statistically significant difference was found (Table 4).

Table 1. Distribution of parasite species detected in stool specimens of patients

Parasite Species	n	%
Blastocystis sp.	26	23.4
Entamoeba coli	3	2.7
Chilomastix mesnili	2	1.8
Entamoeba hartmanni	1	0.9
Giardia intestinalis	1	0.9
Giardia intestinalis + Blastocystis sp.	1	0.9
Microsporidium spp. + *Blastocystis sp.*	3	2.7
Microsporidium spp. + *Cryptosporidium* parvum	1	0.9
Entamoeba coli + Blastocystis sp.	1	0.9
Entamoeba coli + Cryptosporidium parvum	1	0.9
Entamoeba coli + Giardia intestinalis + Blastocystis sp.	3	2.7
Total	**43**	**38.7**

Pearson's chi-square test was used for evaluation of the data.

Table 2. Distribution of parasitic infections according to demographic characteristics and disease story of the patients

		Parasitic infection					
		No		Yes		Total	*P*-Value
Risk Factors		n	%	n	%		
Gender							
	Women	41	56.2	32	43.8	73	0.127
	Men	27	71.1	11	28.9	38	
Age Groups							
	30-39 Years	4	36.4	7	63.6	11	0.468
	40-49 Years	16	59.3	11	40.7	27	
	50-59 Years	19	65.5	10	34.5	29	
	60-69 Years	20	66.7	10	33.3	30	
	70 Years and over	9	64.3	5	35.7	14	
Education							
	Illitarete	27	64.3	15	35.7	42	0.953
	Primary School	33	58.9	23	41.1	56	
	High School	6	60.0	4	40.0	10	
	University	2	66.7	1	33.3	3	
House Type							
	Adobe	15	68.2	7	31.8	22	0.726
	Wooden House	1	50.0	1	50.0	2	
	Reinforced Concrete	52	59.8	35	40.2	87	
Drinking Water							
	Subject Water	25	59.5	17	40.5	42	0.821
	Spring Water	40	61.5	25	38.5	65	
	Well Water	3	75.0	1	25.0	4	
Helmint Infection Story							
	Yes	2	66.7	1	33.3	3	0.668
	No	66	61.1	42	38.9	108	
Allergy Story							
	Yes	28	71.8	11	28.2	39	0.094
	No	40	55.6	32	44.4	72	

Pearson's chi-square test was used for evaluation of the data.

Table 3. Distribution of parasitic infections according to patients' personal hygiene habits

		Parasitic infection					
		No		Yes		Total	*P*-Value
Risk Factors		n	%	n	%		
Having a Pet Animal							
	Yes	10	55.6	8	44.4	18	0.587
	No	58	62.4	35	37.6	93	
Daily Hand Washing							
	1-2 Times	5	100.0	-	-	5	0.079
	4-5 Times	23	60.5	15	39.5	38	
	6 and more	40	58.8	28	41.2	68	
Nail Feeding Habit							
	Yes	10	83.3	2	16.7	12	0.097
	No	58	58.6	41	41.4	99	
Earthen Feeding Habit							
	Yes	1	100.0	-	-	1	0.613
	No	67	60.9	43	39.1	110	

Pearson's chi-square test was used for evaluation of the data.

Table 4. Distribution of parasitic infections according to the clinical status of the patients

	Parasitic infection					
	No		Yes		Total	P-Value
	n	%	n	%		
Cancer Location						
Hematological	6	54.5	5	45.5	11	0.161
Digestive System	25	73.5	9	26.5	34	
Breast	21	46.7	24	53.3	45	
Respiratory System	7	70.0	3	30.0	10	
Bone and Soft Tissue	1	100.0	-	-	1	
Nervous System	2	66.7	1	33.3	3	
Excretory System	2	100.0	-	-	2	
Genital System	4	80.0	1	20.0	5	
Clinical Stage						
No	30	69.8	13	30.2	43	0.569
Grade 1	13	56.5	10	43.5	23	
Grade 2	5	45.5	6	54.5	11	
Grade 3	7	63.6	4	36.4	11	
Grade 4	13	56.5	10	43.5	23	
Metastasis						0.383
Yes	21	67.7	10	32.3	31	
No	47	58.8	33	41.3	80	
Surgical Treatment						0.480
Yes	41	64.1	23	35.9	64	
No	27	57.4	20	42.6	47	
Body structure (By BMI)						
Weak	3	60.0	2	40.0	5	0.641
Normal	29	64.4	16	35.6	45	
Overweight	24	64.9	13	35.1	37	
Obese	12	50.0	12	50.0	24	

Pearson's chi-square test was used for evaluation of the data. BMI; body mass index

Discussion

Each year around 163.500 new cancer cases are diagnosed in Turkey and the number is 14 million worldwide, and cancer is responsible for about 20% of the deaths (22). Cancer is a disease that requires a long struggle due to the health problems it brings along and its effect on the quality of life of the patients. Cancer affects all people, without age, gender, language, religion or race, and a considerable portion is also expected to emerge in underdeveloped countries (22).

Another important health problem of underdeveloped and developing countries is parasitic diseases. It has been reported that countries with especially insufficient infrastructure, in terms of public health, continue to have an important health problem and the prevalence is high (1-6). Parasitic infections, especially infections caused by intestinal protozoa, may cause severe clinical symptoms and fatal complications (such as persistent diarrhea and malabsorption) in cases of immunodeficiency, like in cancer patients, while exhibiting a mild and self-limiting clinical course in immunocompromised individuals (3, 4, 9).

It also increases the risk and prevalence of parasitic infections in immunocompetent individuals compared to the normal population (9, 10). Studies on cancer patients around the world, have reported that the frequency of intestinal parasites varies from country to country and varies between 6.7-88.9% (1, 5, 9, 17, 19). In the south of Brazil and Sao Paulo, the prevalence was 61.6% and 66.7% respectively and it was reported as 6.7% and 10% in Central and Northwest Iran, respectively (1, 5, 9, 17). In Saudi Arabia, the frequency of coccidian parasites in cancer patients with diarrhea is declared to be 88.9% (19). Although there are a few studies on intestinal parasites in immunosuppressive patients and pediatric cancer patients in Turkey, there are differences in the methods and types of parasites investigated (20, 21, 23, 24). In two studies, the incidence of intestinal parasites was reported to be 22.5% (14) in immunosuppressed patients and 30.3% (20) in pediatric cancer patients. In a study investigating only *Microsporidium spp*. in cancer patients, the prevalence was 17.8% (16), and in another study investigating only *Cryptosporidium parvum (C.parvum)*, prevalence it was found to be 12.3% by ELISA (Enzyme Linked Immunosorbent Assay) method and 7.8% by kinyoun acid fast staining method (23). In our study, the incidence of intestinal protozoa was 38.7% in adult patients diagnosed with cancer. The prevalence of intestinal protozoa in our study group is higher than the prevalence (4.0-22.4%) detected in the normal population in our country and our region (10-15). However, the study in which all intestinal parasites are investigated shows similarities to rates found in children with cancer (20).

Immunosuppression also changes the diversity of parasitic infectious agents in patients (3). Opportunistic pathogens, especially *Cryptosporidium spp*. and *Microsporidium spp*., predominate in immunocompetent individuals (1, 4, 9, 16, 17, 19), while *Entamoeba spp*., *Giardia intestinalis (G. intestinalis)* and *Blastocystis sp.* are more commonly encountered in immunocompetent individuals (10-13, 21, 23). In our study, the most common intestinal protozoon was *Blastocystis sp.* (30.6%) followed by *E. coli* (7.2%) and *G. intestinalis* (4.5%). *Microsporidium spp*. and *C. parvum* were found in 3.6% and 1.8%, respectively. *C. parvum* (1, 5, 19), *Blastocystis sp.* (1, 9) and *G. intestinalis* (17) have been reported as the most common intestinal protozoa in some studies in cancer patients. Sonmez et al. (23) reported the prevalence of cryptosporidiosis in diarrheal children with leukemia and lymphoma, diagnosed with kinyoun acid fast staining and ELISA as 7.86% and 12.35%, respectively. Karaman et al. (21) reported that the incidence of *Microsporidium spp*. in cancer patients was 10.9%. Compared to the results of these studies, the prevalence of *C. parvum* and *Microsporidium spp.* is lower in our study. This difference may be related to the study group, difference and sensitivity of the method used.

Studies that investigated the risk factors that may affect the prevalence of intestinal protozoa in cancer patients have reported different results depending on the study group and region. Jeske et al. (5) reported that there was no association between the prevalence of parasitic infections and the type of cancer, but the prevalence was high among those with pets. Rasti et al. (9) and Mohammadi-Ghalehbin et al. (1) did not find a relationship between age, educational level and prevalence of parasitic infections, but Rasti et al. (9) and Sanad et al. (19) found that the frequency of parasitic infection was higher in men than in women. Durak et al. (20) reported that in cancer patients with anal itching and crowded number of individuals sharing the same home, the prevalence of parasitic infections was higher. In our study, there was no statistically significant difference in the distribution of parasitic infections according to patients' demographics, illness stories, personal hygiene habits, clinical status, and complaints.

It is important to determine the frequency of parasitic diseases, parasite types and risk factors that may affect the follow-up and treatment process and the quality of life of the immunocompromised patients, such as cancer patients. We think that this area needs more research, which will help clinicians and create new approaches for patients' treatment and follow-up.

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