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The Impact of COVID-19 Pandemic on Access to Healthcare: The Experience of the Diagnostic Parasitology Laboratory of Ege University

COVID-19 Pandemisinin Sağlık Hizmetlerine Erişime Etkisi: Ege Üniversitesi Parazitoloji Direkt Tanı Laboratuvarı Deneyimi

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ABSTRACT

Objective: Beyond the Coronavirus disease-2019 (COVID-19) itself, the pandemic influenced healthcare settings in all aspects. It is aimed to demonstrate the effect of the pandemic on access to the healthcare setting in the parasitology direct diagnosis laboratory.

Methods: Stool parasitological examination results were obtained retrospectively from the laboratory information system. Data belonging to the one-year of pandemic, lock-down and gradual normalization periods and their time equivalents were compared retrospectively.

Results: During pandemic, parasites were detected in 529 of 2.233 samples. Parasites were detected in 58 of the 178 samples during the lock-down period and 471 of the 2.055 samples in the gradual normalization period. Incidence of *Cryptosporidium* spp. increased during the pandemic and lock-down periods. Incidence of *Blastocystis* spp. decreased during the pandemic and gradual normalization periods. Incidence of *Giardia intestinalis* decreased during the pandemic and gradual normalization periods. Incidence of *Entamoeba histolytica/dispar* increased during the pandemic and gradual normalization periods Incidence of *Cyclospora* spp. increased during the pandemic and gradual normalization periods. Incidence of *Enterobius vermicularis* decreased during the pandemic and gradual normalization periods and no case was seen during the lock-down period.

Conclusion: Although the incidence of parasites gives the impression that COVID-19 does not cause weakness in the fight against intestinal parasitic diseases, there may be parasitic infections with a similar frequency in the society that cannot access the laboratory. It is predicted that the effects of this vulnerability may lead to an increase in the incidence of parasites in post-pandemic period.

Keywords: COVID-19, healthcare, intestinal parasites

ÖZ

Amaç: Koronavirüs hastalığı-2019 (COVID-19) pandemisi sağlık hizmetlerini her açıdan etkilemiştir. Bu çalışmada, parazitoloji direkt tanı laboratuvarında pandeminin sağlık hizmetlerine erişim üzerindeki etkisinin ortaya konulması amaçlanmıştır.

Yöntemler: Dışkı parazitolojik inceleme sonuçları laboratuvar bilgi sisteminden geriye dönük olarak elde edildi. Pandeminin bir yılı, tam kapanma ve kademeli normalleşme dönemlerine ait veriler ve bunların zaman eşdeğerleri geriye dönük olarak karşılaştırıldı.

Bulgular: Pandemi sırasında 2,233 örneğin 529'unda parazit tespit edildi. Tam kapanma döneminde 178 örneğin 58'inde ve kademeli normalleşme döneminde 2,055 örneğin 471'inde parazit tespit edildi. *Cryptosporidium* spp. insidansı pandemi ve tam kapanma dönemlerinde arttı. *Blastocystis* spp. insidansı pandemi ve kademeli normalleşme dönemlerinde azaldı. *Giardia intestinalis* insidansı pandemi ve kademeli normalleşme dönemlerinde azaldı. Pandemi ve kademeli normalleşme dönemlerinde *Entamoeba histolytica/dispar* insidansı arttı. Pandemi ve kademeli normalleşme dönemlerinde *Cyclospora* spp. insidansı arttı. Pandemi ve kademeli normalleşme dönemlerinde *Enterobius vermicularis* insidansı azaldı ve tam kapanma döneminde olgu görülmedi.

Sonuç: Parazitlerin görülme sıklığı, intestinal parazit hastalıkları ile mücadelede COVID-19'un zayıflığa neden olmadığı izlenimini verse de toplumda laboratuvara ulaşamayan kişilerde de benzer sıklıkta parazit enfeksiyonları olabilir. Bu zaafiyetin etkilerinin pandemi sonrası dönemde parazitlerin görülme sıklığında artışa yol açabileceği tahmin edilmektedir.

Anahtar Kelimeler: COVID-19, sağlık bakımı, bağırsak parazitleri

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Türkiye PARAZİTOLOJİ Dergisi

INTRODUCTION

A cluster of acute respiratory disease cases, later named Coronavirus disease-2019 (COVID-19), occurred in December 2019 that was linked to a seafood market in Hubei Province of Wuhan, China (1-3). The World Health Organization (WHO) declared COVID-19 as a pandemic on March 11, 2020, while 118,319 cases were confirmed globally (4). The first laboratory-confirmed COVID-19 case in our country was declared on March 11, 2020, by the Republic of Turkey Ministry of Health (5). The number of globally confirmed cases on March 14, 2021, was 119.218,587 and the total global number of deaths was 2.642,673 according to the WHO situation report (6).

Beyond the COVID-19 itself, the pandemic influenced healthcare settings in all aspects. Since the first case in our country on March 11, 2020, the Ministry of Health has taken various measures. It is obvious that measures such as lock-down and outpatient restriction will reduce patient admission to the hospital but there are no real-life data present to date.

Intestinal parasites such as *Cryptosporidium* species, *Giardia intestinalis* and *Entamoeba histolytica* cause transmissible diseases. The control of these parasitic diseases is a long-term process, which is provided by using appropriate diagnostic methods, effective surveillance, providing appropriate sanitation conditions and reducing the circulating parasite load with effective treatments. Eliminating the effects of a weakness in the fight against intestinal parasitic diseases may require years of struggle. In this context, disruption of services provided by diagnostic parasitology laboratory is of critical importance for public health.

This study aims to demonstrate the effects of the COVID-19 pandemic on access to healthcare settings for diagnostic parasitology laboratory.

METHODS

The study was conducted in the Laboratory of Medical Parasitology Department of Ege University Faculty of Medicine. Ege University, which is the largest university hospital in its region, providing healthcare services to neighboring cities in the Aegean region. Various clinical samples of approximately 6.000 patients are evaluated in terms of parasitic infections annually in the parasitology laboratory where the study was conducted. In the study, the data belonging to the pandemic period and the pre-pandemic period were compared retrospectively. To eliminate seasonal effects, the period after the declaration of the pandemic was compared with the equivalent period of the previous year. The data of the pandemic period were analysed in two periods, the period of "lock-down" and the period of "gradual normalization". The period of lock-down was begun on March 11, 2020 and ended on May 31, 2020. The period of gradual normalization was started on June 1, 2020 and went on for the rest of the year till March 10, 2021. In the mentioned periods, stool parasitological examination results were obtained retrospectively from the laboratory information system of Ege University Parasitology Laboratory. The total number of faeces admitted to laboratory, the number of faeces with one or more parasites detected in these applications, and the number of parasite species detected were recorded.

Statistical Analysis

Research data were expressed as numbers and percentages. The resulting data were analysed using Office 365® Excel (Microsoft, United States of America) software. The relationship between categorical variables was examined using the Pearson's chi-square test. The degrees of freedom were calculated using the formula "$DF = (n_{row}-1) \times (n_{column}-1)$";. The chi-square value was calculated using the formula "$\chi^2 = \sum (f_{observed} - f_{expected})^2 / f_{expected}$

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". With the obtained chi-square and degrees of freedom values, p-values were calculated using the online p calculator application (accessed from https://www.socscistatistics.com/pvalues/chidistribution.aspx). P-values below 0.05 were considered statistically significant. Fisher's Exact test was used for the tables with expected frequencies below 5. Fisher's Exact test was carried out with the online Simple Interactive Statistical Analysis tool (accessed from https://www.quantitativeskills.com/sisa/statistics/fisher.htm).

RESULTS

The total number of faeces admitted to parasitology laboratory, the number of faeces with one or more parasites detected in these applications, the number of parasite species detected, and calculated p-values for both pandemic and pre-pandemic periods were given in the table (Table 1).

During the one-year period of the pandemic, 2.233 patient samples were admitted by parasitology laboratory, in which 529 (23.7%) were found to be positive by parasites. It was determined that parasites were detected in 1.058 of 4.914 samples accepted in the one-year period before the pandemic. The frequency of parasite detection was found to be significantly higher in samples accepted during the pandemic period (p=0.041).

When the sub-periods of the pandemic were evaluated, parasites were detected in 58 of the 178 patient samples admitted during the lock-down period. It was observed that parasites were detected in 105 of the 1.073 patient samples accepted in this date range before the pandemic. The frequency of parasite detection in samples accepted during the lock-down period was significantly higher than the same period one year ago (p<0.00001).

Parasites were detected in 471 of the 2.055 patient samples admitted in the gradual normalization period. Parasites were detected in 953 of 3.841 patient samples admitted in this date range prior to the pandemic. The frequency of parasite detection in samples accepted during the gradual normalization was not significantly different with the same period previous year (p=0.105).

When the incidence of parasite species was evaluated separately according to the periods, it was seen that the incidence of *Cryptosporidium* spp. increased significantly during the pandemic and lock-down periods (p<0.00001 and p=0.0008, respectively) (Figures 1, 2). The incidence of *Blastocystis* spp. and the incidence of *Giardia intestinalis* decreased significantly during the pandemic and gradual normalization periods (for *Blastocystis* spp. p=0.0007 and p=0.0004, respectively; for *Giardia intestinalis* p=0.047 and p=0.033, respectively). The incidence of *Entamoeba histolytica/dispar* and the incidence of *Cyclospora* spp. increased significantly

Table 1. The total number of faeces admitted to the laboratory, the number of faeces with one or more parasites detected in these applications, the number of parasite species detected

	Lock-down	Lock-down equivalent	p*	Gradual normalization	Gradual normalization equivalent	p*	Pandemic one year	Pandemic one-year equivalent	p*
The number of admission	178	1073		2055	3841		2233	4914	
The number of samples with at least one parasite	58	105	<0.00001	471	953	0.105	529	1058	0.041
Cryptosporidium spp.	34	40	<0.00001	356	642	0.552	390	682	0.0008
Blastocystis spp.	9	48	0.729	50	162	0.0004	59	210	0.0007
Giardia intestinalis	0	1	NA	2	15	0.033	2	16	0.047
Entamoeba histolytica/ dispar	6	3	0.052	28	19	0.045	34	22	<0.00001
Cyclospora spp.	3	2	0.232	18	18	<0.00001	21	20	0.0056
Enterobius vermicularis	0	7	NA	1	28	0.0006	1	35	0.0002
Mixed	5	3	0.002	16	63	0.006	21	66	0.150
Other rare parasites	1	1	0.264	0	6	NA	1	7	0.231

* p<0.05 were considered statistically significant, NA: Not applicable

during the pandemic and gradual normalization periods (for *Entamoeba histolytica/dispar* p<0.00001 and p=0.045, respectively; for *Cyclospora* spp. p<0.00001 and p=0.045, respectively). Not only the incidence of *Enterobius vermicularis* decreased significantly during the pandemic and gradual normalization periods (p=0.0002 and p=0.0006, respectively) but also no case was seen during the lock-down period (Table 1).

DISCUSSION

Since the COVID-19 infection was declared as a pandemic, WHO has been publishing case and mortality data from all countries. Despite the existence of more than one effective severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) vaccine, the pandemic is still active with regular peaks. It is obvious that COVID-19 has become a major public health issue due to the chaotic environment it created in health services, as well as its damage. Although it varies between countries, regions, states and even cities, various measures are taken according to the spread rate and mortality of the virus. Measures may also restrict access to hospital for people suffering from diseases other than COVID-19. It has been stated in various publications that death and morbidity from non-communicable diseases, cancers and other conditions will accelerate over time without adequate care (7-9). The effect of the measures taken with a holistic approach on the healthcare system is a matter of debate. Providing access to the healthcare system in the most efficient way or planning for COVID-19 infection has become a double-edged sword for healthcare managers.

Three of the intestinal parasitic infections, *Cryptosporidium* species, *Giardia intestinalis* and *Entamoeba histolytica*, are within the scope of group D notifiable diseases (10). Therefore, disruption of parasitology laboratory services is of critical importance in terms of public health. The control of these parasitic diseases is a long-term process, which is provided by using appropriate diagnostic methods, effective surveillance, providing appropriate sanitation conditions and reducing the circulating parasite load with effective treatments.

In this manner we aimed to demonstrate the effect of the COVID-19 pandemic on access to the parasitology laboratory. During the lock-down period, outpatient admission to our hospital was completely stopped. In the gradual normalization period, outpatient admission continued with limiting the number of patients admitted daily. During the one year of pandemic and lock-down periods, the frequencies of parasites detected in faeces were significantly higher than the pre-pandemic periods while there was no significant difference for the gradual normalization period. We considered that this was due to the lack of outpatient services, practices such as pre-employment porter screening and preschool screening during the pandemic period, and the relative increase in hospital admissions of patients with clinical signs and symptoms.

When the diagnosed parasite species were considered one by one, it was observed that the frequency of *Cryptosporidium* species, the most common intestinal protozoan in the region where our laboratory is located, increased significantly in one year of the pandemic and during the lock-down period, while the frequency of *Blastocystis* species and *Giardia intestinalis* decreased significantly in one year of the pandemic and during the gradual normalization period. On March 11, 2020, the first day that the pandemic reached our country, we did a risk assessment for COVID-19 in our laboratory and changed various standard operating procedures. Briefly, we stopped cellophane

tape investigation, native-lugol wet mount examination and modified formol ethyl acetate concentration due to the high risk of SARS-CoV-2 transmission during microscopic examination. We applied trichrome staining and acid-fast staining to all stool samples accepted to the parasitology direct diagnosis laboratory (11). It was expected that the incidence of parasites would increase in the samples we examined, since inpatient service overtakes outpatient services during the pandemic. While the procedures for the diagnosis of *Cryptosporidium* during the lock-down period continue without reducing our test sensitivity, we think that the incidences of *Blastocystis* species and *Giardia intestinalis* were not elevated during the lock-down period since the direct microscopic examination method, which we used as a sensitive diagnostic test for *Blastocystis* species and *Giardia intestinalis*, could not be applied. In the pre-pandemic period, we were diagnosing parasites in the stool samples of many patients from the dermatology outpatient clinic of our hospital, especially regarding patients with allergy and urticaria complaints. In a study conducted in our laboratory in previous years, it was shown that *Blastocystis* species are common in patients who applied to the dermatology outpatient clinic (12). Another reason for the decrease in the frequency of *Blastocystis* species is thought to be the relative decrease in the number of patients who applied to the dermatology outpatient clinic during the pandemic period. It can hypothetically be said that hygiene and distance measures taken during the pandemic period may reduce the incidence of *Enterobius vermicularis*. However, since the cellophane tape test was not applied in our laboratory during the pandemic, it

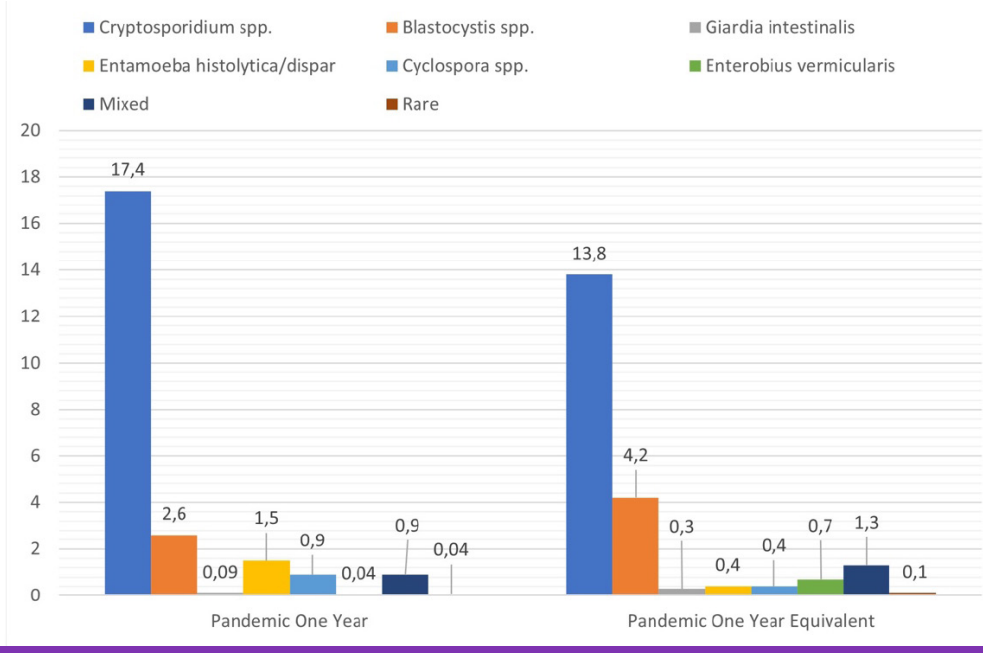

Figure 1. Prevalence of parasite species (%) during the one year of pandemic and equivalent period

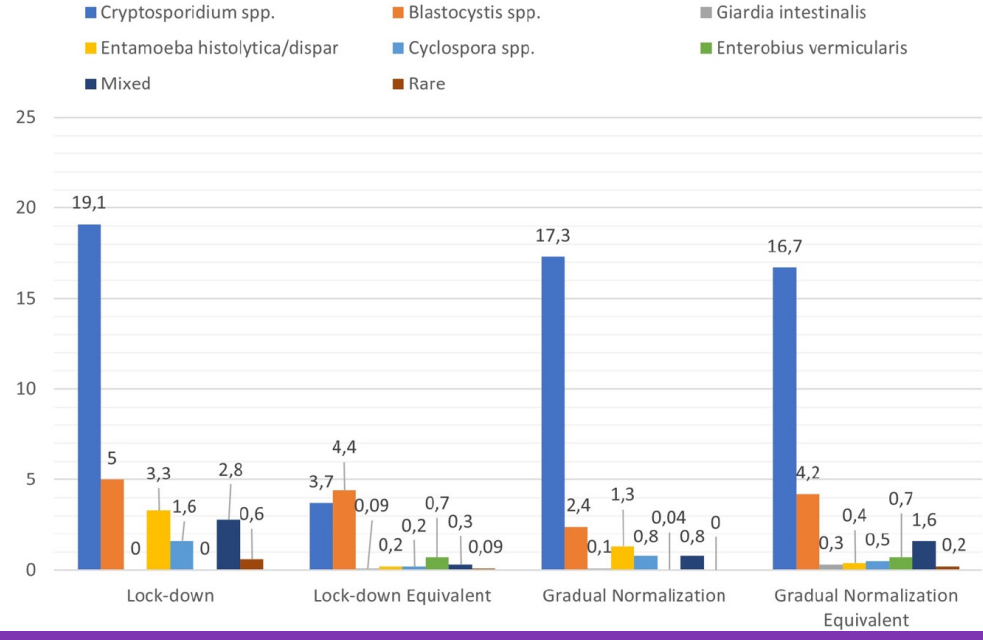

Figure 2. Prevalence of parasite species (%) during lock-down and gradual normalization and their equivalent periods

is not appropriate to comment on our incidence of *Enterobius vermicularis* in this period.

Although there are publications on the effect of the pandemic on the frequency of various parasitic diseases, studies on intestinal parasites are limited (13,14). In order to evaluate the data of the pandemic period in epidemiological studies to be carried out in the post-pandemic period, it is important to document the data of this extraordinary period with its justifications.

CONCLUSION

Considering the data of this study, although the incidence of parasites gives the impression that COVID-19 does not cause weakness in the fight against intestinal parasitic diseases, there is a mandatory and significant decrease in the number of samples accepted to the laboratory compared to the previous year. Considering that there may be parasitic infections with a similar frequency in the society that cannot access the laboratory, this stands as an important problem in combating intestinal parasitic infections. It is predicted that the effects of this vulnerability may lead to an increase in the incidence of intestinal parasites in the post-pandemic period.

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*Ethics

Ethics Committee Approval: Since the study was retrospective and only parasite frequencies were shared anonymously, ethics committee approval was not obtained.

Informed Consent: Since this is a retrospective study and only parasite frequencies were shared anonymously, informed consent was not obtained.

Peer-review: Internally peer-reviewed.

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