ORIGINAL ARTICLE

EFFECTS OF THE COVID-19 PANDEMIC ON THE DEMOGRAPHIC OF ONCOLOGICAL PATIENTS AND THE USE OF PET/CT UTILIZATION

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ABSTRACT

Aims: Although the coronavirus disease-2019 (COVID-19) pandemic has created various health problems in many people, it has also caused disruptions in the clinical management of patients with existing cancerous diseases. This retrospective cohort study aims to observe the impact of the COVID-19 pandemic on positron emission tomography/computed tomography (PET/CT) utilization, which has an important role in the diagnosis, staging, and follow-up of cancer patients.

Methods: The data of 6,053 patients who have undergone PET/CT imaging from 2019 to 2021 at the Nuclear Medicine Department of Trakya University School of Medicine was analyzed. To examine the situation before and after COVID-19 pandemic, we compared the data of 6-month periods from March 11 to September 8, from 2019 to 2021, starting from March 11, 2020, when the first case was seen in Turkey. Patients' age, type of cancer, and date of the PET/CT scans were recorded.

Results: The mean ages of the patients admitted in 2019, 2020, and 2021 were 61.93±13.09, 61.16±13.29, and 61.57±13.78 years, respectively. Bronchus and lung cancer were the most common cancer type regardless of year or age group, with an average of 29.37%. The second and the third most common types of cancer were breast cancer with 9.60% and prostate cancer with 8.31%, respectively. When compared with April 2019, PET/CT scan numbers declined in April 2020. We observed a negative correlation between the number of PET/CT scans and the number of COVID-19 cases from week one through week five.

Conclusion: The COVID-19 outbreak had an important effect on PET-CT scans performed at Trakya University School of Medicine.

Keywords: COVID-19, PET-CT scan, pandemic

INTRODUCTION

Ever since the World Health Organization declared the spread of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) a pandemic, many countries imposed new restrictions against its spread (1). Clinical management of coronavirus disease-2019 (COVID-19) at hospitals offers various medical treatments and supportive care options such as mechanical ventilatory support, supplemental oxygen, etc. (2). The number of non-COVID-19 patients coming to hospitals for urgent needs has decreased significantly, as healthcare resources are predominantly reserved for the demands of COVID-19 patients and outpatients had a fear of contracting the virus from hospitals (3). Medical imaging centers and radiology departments have also been negatively impacted by public policies prioritizing COVID-19 patients, with

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many seeing declines in medical imaging case volumes (4).

Cancer, medically known as a malignant neoplasm, is either the first or second cause of death before reaching the age of 70 in majority of countries (5). Early diagnosis of the disease vastly increases the chance of effective treatment, and various screening tests can be used (6). Positron emission tomography/ computed tomography (PET/CT) is a screening test introduced in the first decade of the 21st century and gaining popularity among researchers working on oncology (7). PET can detect tissue metabolism disorders, and CT shows changes in structures (8). This imaging technique is currently the most popular because of its advantages. PET/CT is highly effective in detecting metabolically active malignancies due to its increased specificity and sensitivity (9).

This retrospective cohort study aims to observe the impact of the COVID-19 pandemic on PET/CT use by investigating the relationship between PET/CT imaging volume and weekly COVID-19 cases.

MATERIAL AND METHODS

This retrospective cohort study was approved by the Scientific Research Ethics Committee of Trakya University School of Medicine (Protocol Code: TÜTF-BAEK 2022/02).

Patients who underwent PET/CT imaging at the department of nuclear medicine of Trakya University School of Medicine, between March 2019-August 2021 were retrospectively evaluated. Patients who underwent F-18 fluorodeoxyglucose PET/CT and 68-Ga labeled prostate-specific membrane antigen PET/CT imaging for oncological diagnosis, staging, restaging, or treatment response, and whose demographic data could be obtained, were included in the study.

Data was analyzed for 6-month periods from March 11 to September 8, for the years 2019, 2020, and 2021. The weekly variance in the number of PET/CT scans in correlation to confirmed COVID-19 cases in Turkey was investigated. The data regarding patient demographics were classified by age and the type of malignancy. The mean age of the patients was calculated to investigate the effects of the COVID-19 pandemic on patients admitted to the hospital for PET/CT scans.

Statistical Analysis

The statistical analysis was performed using IBM SPSS version 27.0 (SPSS Inc., Chicago, IL, USA). Microsoft Excel (version 16.50) and Graph Prism (GraphPad Prism version 8.0.0 for Windows, GraphPad Software, San Diego, California USA) were also used in the statistical analysis of our study. Simple linear regression was used to evaluate the relationship between weekly COVID-19 cases and the weekly number of procedures. The Mann-Whitney U test was used to determine the difference in the number of performed PET/CT scans from 2019 to 2021. The data of patients aged 65 years and older were evaluated separately, in order to get a better sense of the effects of the COVID-19 pandemic on high-risk age groups. The test was utilized to see if there were any associations between the 6-month periods from March 11 to September 8, from 2019 to 2021, especially after the first confirmed case of COVID-19 was declared in Turkey in March 2020. A p-value of <0.05 was considered to be statistically significant.

RESULTS

In this retrospective study, 6,053 patients were included. Malignant neoplasm of bronchus and lung was the most common diagnosis in 2019, 2020, and 2021 with a total percentage of 29.37%. The top ten most common causes of referrals were, in descending order: bronchus and lung cancer, breast cancer, prostate cancer, specified and unspecified types of non-Hodgkin lymphoma, disseminated malignant neoplasms, colon cancer, laryngeal cancer, rectal cancer, stomach cancer, multiple myeloma, and malignant plasma cell neoplasms, respectively. The percentage of each diagnosis by year is shown in Table 1.

The mean ages of the patients admitted in 2019, 2020, and 2021 were 61.93±13.09, 61.16±13.29, and 61.57±13.78 years, respectively. The mean age of all three years was 61.56±13.39 years. The number of admissions by age intervals (<18, 18-65, >65 years) was also analyzed, and the only statistically significant decrease was observed in the number of patients aged over 65 years in the first year of the pandemic compared to the previous year (p=0.008). The number of patients over 65 years was 942, 821, and 957 in 2019, 2020, and 2021, respectively.

Table 1: The percentages of ten most common cancer types.				
	2019 (%)	2020 (%)	2021 (%)	Total (%)
Bronchus and lung cancer	30.82	31.32	26.25	29.37
Prostate cancer	8.27	6.55	10.00	8.31
Non-Hodgkin lymphoma	7.89	7.74	7.28	7.63
Breast cancer	7.50	11.48	12.13	9.60
Disseminated malignant neoplasm	7.45	7.74	7.52	7.57
Colon cancer	4.74	3.90	3.40	4.01
Laryngeal cancer	3.05	2.81	3.15	3.01
Rectal cancer	2.81	3.06	2.52	2.46
Stomach cancer	2.66	2.23	1.65	2.18
Multiple myeloma and malignant plasma cell neoplasms	2.61	2.13	1.65	2.26

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The age distribution of the patients was seen as follows: 1% of the patients were under 18 years, 44.9% of the patients were over 65 years, and the majority of the patients were between 18-65 years with a rate of 53.4%. The age data of 0.7% (42 patients) of the patients' could not be reached. Considering the most common diagnoses in patients aged under 18 years, between 18-65 years, and 65 years and over in 2019, 2020, and 2021, it can be said that bronchus and lung cancer is the most common cancer type regardless of age groups.

When each cancer group (ten most common types in 2019) was evaluated by years (Figure 1), it was seen that there was a decrease in the number of bronchus and lung cancer, non-Hodgkin lymphoma, prostate cancer, colon cancer, laryngeal cancer, and multiple myeloma cases. Only breast cancer and rectal cancer cases were increased in 2020.

The number of COVID-19 cases has increased until the 2nd week of April 2020 and reached the peak, while the number of patients undergoing PET/CT scanning has shown a statistically significant decrease (p=0.008). In the following weeks, it is seen that the number of cases started to decrease and the number of patients screened began to increase. After mid-June 2020, it can be said that both the number of cases and screening admissions remained stable on average. In general, there was a decrease in the number of scans at the beginning of the pandemic, and as the number of COVID-19 cases decreased, applications for PET/CT scans started to increase again (Figure 2). Neither in 2020 (p=0.390) nor 2021 (p=0.410) did this initial decline in the total number of PET/CT scans following the COVID-19 outbreak was statistically significant. However, the increase in the number of weekly COVID-19 cases resulted in a decline in procedures performed through 2020 (p=0.001).

DISCUSSION

Given the severity of the clinical consequences of COVID-19 for cancer patients, clinicians had to decide whether to continue or delay cancer screenings as planned to reduce the risk of infection, especially during the initial outbreak of the new SARS-CoV-2 (10). Compared to April 2019, we observed a significant decrease in the total number of PET/CT scans in April 2020, which may have occurred due to insufficient knowledge of the epidemiological and clinical features of the new disease. A slight decrease was observed in the number of PET/CT scans in April 2021 compared to 2019, but the numbers were still higher than in 2020 in the same period. This slight increase may have been due to extensive research on COVID-19, the development of vaccines against the virus, and the general public's adaptation to the pandemic, which provides healthcare professionals with information to combat the new disease. Despite the initial decrease in the total number of PET/CT scans following the COVID-19 pandemic, no significant reductions were detected in 2020 or 2021.

Older adults are at higher risk for adverse clinical outcomes of COVID-19 (11). After the first outbreak, in April 2020, a significant decrease was observed in the number of PET/CT scans of patients over the age of 65 compared to baseline. However, there was no significant decrease over the following year. Similarly, no significant change was observed in patients under the age of 18 and between the ages of 18-65.

The COVID-19 pandemic has had different effects on the imaging of certain types of cancer. According to Table 1, among the ten most prevalent cancer types we looked at, the percentage of cases screened for six types of cancer (i.e., prostate cancer, colon cancer, stomach cancer, laryngeal cancer, non-Hodgkin lymphoma, and multiple myeloma and malignant plasma cell neoplasms) decreased while the percentage of other four types (i.e., bronchus and lung cancer, breast cancer, rectal cancer, and disseminated malignant neoplasm) increased. The highest decrease in the percentage of screened cases was observed in prostate cancer by 1.72% and the highest increase in the percentage of cases screened was observed in breast cancer by 3.98%. In parallel with our study, Kaufman et al. (12) also showed a decrease in new cases of same six cancer types during the COVID-19 pandemic period.
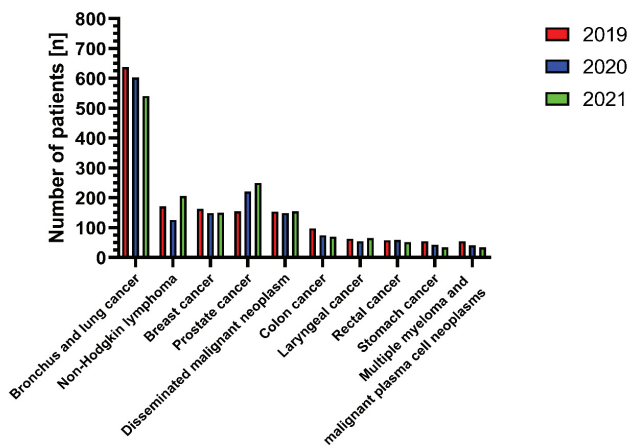

Figure 1: Number of patients regarding each of the most common ten cancer types in 2019, 2020, and 2021.
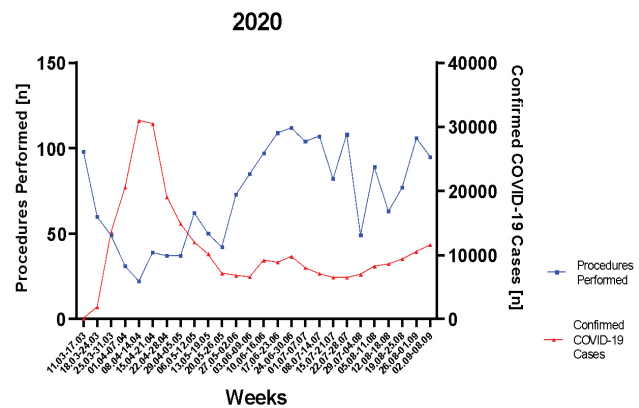

Figure 2: Number of PET/CT scan procedures performed and confirmed COVID-19 cases in Turkey between March 2020 and September 2020.
PET/CT: Positron emission tomography/computed tomography, COVID-19: Coronavirus disease-2019

It was estimated that the imaging volume for radiology applications would decrease by 50-70% in the first 3-4 months of the pandemic (13). Although our data show that PET/CT scans were not affected by this magnitude, the increase in the weekly number of COVID-19 cases still resulted in a decrease in procedures performed in 2020. On March 11, 2020, the first confirmed COVID-19 case was reported in Turkey. There was a significant decrease in the number of PET/CT scans from week one to week five, with a negative correlation as expected with the number of confirmed COVID-19 cases. The negative correlation between the transactions performed and the confirmed cases lasted for eight weeks. This instant volume loss can be interpreted as a result of the government-issued "stay at home" order for people aged 65 years and over on March 21, 2020. Another reason would be the anxiety of patients and their caregivers since even from the beginning of the outbreak, cancer patients were placed in high-risk groups which are most likely to die due to developing severe symptoms of COVID-19. However, one study showed that, among the five different imaging models, PET/CT scans were the least affected because oncological patients needed continuous and immediate treatment (14). Eleven weeks after the first confirmed case of COVID-19 patient in Turkey, improvement in imaging volume began to be seen, but it would be wrong to interpret this as a complete recovery, as after increasing for five weeks, the number of performed procedures showed irregular increases and decreases, regardless of the increasing number of COVID-19 cases. It would not be wrong to say that the public has adapted to the pandemic as time has passed and that the relaxation of social distancing regulations in the summer months of the year 2020 led to an increase in COVID-19 cases and a simultaneous increase in PET/CT scans.

A possible limitation of this study may be the small number of patients under 18 years of age and the lack of age-related data for 42 patients. Another limitation is that the analyzed data were obtained from only one hospital. Multicenter studies will provide a better understanding of the impact of the COVID-19 pandemic on nuclear medicine and radiology departments on a national or global scale.

CONCLUSION

The COVID-19 outbreak had a statistically significant effect on PET/CT scans, especially in the first weeks of the outbreak. Different cancer types were affected differently. There were no statistically significant changes in the number of scans performed on patients aged 18-65 years.

Ethics Committee Approval: This retrospective cohort study was approved by the Scientific Research Ethics Committee of Trakya University School of Medicine (Protocol Code: TÜTF-BAEK 2022/02).

Informed Consent: Informed consent was obtained from all of the subjects.

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