ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Impacts of COVID-19 Pandemic on Computed Tomography Usages in Emergency Department: Cross-sectional Study

COVID-19 Pandemisinin Acil Bilgisayarlı Tomografi Kullanımına Etkileri: Kesitsel Çalışma

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This study was presented as an oral presentation at 5th Medicine and Health Sciences Researches Congress UTSAK Congress, 12-13 December 2020, Online.

ABSTRACT Objective: To investigate the number of performed computed tomography (CT) scans in emergency department at our institution during the coronavirus disease-2019 (COVID-19) pandemic in comparison to the same period of the previous year. **Material and Methods:** In this retrospective study, we evaluated CT imaging data in the emergency department in April to June timespan in the years of 2019 and 2020. Monthly admitted patient numbers, CT imaging case volumes, age and gender of the patients underwent CT scans at emergency department were noted and compared for each year. For the year 2020, among the CT performed patients who had suspicious and non-suspicious symptoms for COVID-19 and who had positive reverse transcryptase polymerase chain reaction test were noted for each month. The Student t-test was used for comparison of variables in two groups. **Results:** In 2020, despite the decrease in total number of patients admitted to emergency department, CT utilization was increased more than 12 times compared to 2019. In comparison to 2019, the mean age of CT performed patients was significantly younger in 2020 ($p<0.001$). Among the CT performed patients, brain (68.5%) and chest (88.6%) were the most scanned anatomical sites in 2019 and 2020, respectively. Based on couple comparisons for all anatomical sites, there was a significant increase in chest CT utilization in 2020 ($p<0.001$). **Conclusion:** During the COVID-19 pandemic CT usages increased, a higher rate of chest CT was performed and younger patients were scanned in emergency department compared with 2019.

Keywords: COVID-19; computed tomography usage; chest computed tomography

ÖZET Amaç: Bu çalışmada amacımız, koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)] pandemisinde acil bilgisayarlı tomografi (BT) kullanımını, bir önceki yılın aynı dönemiyle karşılaştırarak araştırmaktır. **Gereç ve Yöntemler:** Bu çalışmada, acil serviste 2019 ve 2020 yıllarında Nisan-Haziran ayları arasında, BT inceleme verilerini retrospektif olarak değerlendirdik. Acil servise kabul edilen hasta sayıları, BT inceleme sayıları, acil BT incelemesi yapılan hastaların yaş ve cinsiyetleri not edildi ve 2019 ile 2020 yıllarındaki verileri karşılaştırıldı. 2020 yılında BT incelemesi yapılan hastalar arasında, COVID-19 enfeksiyonu açısından şüpheli semptomları olan ve polimeraz zincir reaksiyonu testi pozitif olan hastalar kaydedildi. Her iki gruptaki değişkenlerin karşılaştırılmasında Student t-testi kullanıldı. **Bulgular:** 2020 yılında, acil servise başvuran toplam hasta sayısının azalmasına rağmen BT kullanımı 2019 yılıyla karşılaştırıldığında 12 kattan fazla artmıştır. BT incelemesi yapılan hastaların ortalama yaşı 2020 yılında, 2019 yılına göre istatistiksel olarak anlamlı daha düşüktü ($p<0,001$). BT incelemesi yapılan hastalar arasında beyin (%68,5) ve toraks (%88,6) her iki yıl için en çok taranan anatomik alanlardı. Tüm anatomik alanların ikili karşılaştırmasında, 2020 yılında toraks BT kullanımında istatistiksel açıdan anlamlı artış saptandı ($p<0,001$). **Sonuç:** COVID-19 pandemisi sırasında, acil BT kullanımı 2019 yılına göre artmıştır, geçen yıla göre daha yüksek oranda toraks BT uygulanmıştır ve daha genç hastalar incelenmiştir.

Anahtar Kelimeler: COVID-19; bilgisayarlı tomografi kullanımı; toraks bilgisayarlı tomografi

Since coronavirus disease-2019 (COVID-19) has spread almost all countries and/or territories, many things changed in the world. At the time of writing this article, more than 34 million cases and one million deaths had been documented globally related to on-going COVID-19 pandemic.[1] Therefore, the vast majority of health care applications and services encountered dramatical changes. Two main rea-

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sons for these changes were conserving health care resources for potential patient surge and minimizing the risk of disease transmission among patients and healthcare workers.

Similarly, radiology practices were also affected dramatically during this pandemic.[2-4] In general, elective or non-urgent appointments were postponed. In addition, stay at home recommendations and restrictions also contributed to sharp case volume decreases in radiology departments and anecdotal articles declared up to 70% lost in their imaging case volumes.[5] However, given that chest computed tomography (CT) scans have crucial role for the immediate diagnosis of COVID-19, thereby, limiting the disease transmission, it may be an exception to case volume decreases particularly in the emergency setting. Although many studies described CT findings in COVID-19 patients, most of the studies did not focus on the percentage of performed CT scans on suspected but polymerase chain reaction (PCR) negative cases.[6,7] Moreover, one study reported that urgent CT scans non-related to COVID-19 demonstrated a sharp decrease which suggested potential undiagnosed emergencies during the pandemic.[8] Therefore, we considered that an actual data from real world about how urgent CT scan utilization changed during the pandemic in emergency setting would be important for health care providers in decision making processes for potential future waves of the pandemic.

In this study, we aimed to define the increase in workload in emergency radiology department due to pandemic conditions. Moreover, we aimed to determine the usage rates of CT scans and to evaluate the efficiency of tomography, which also brings the risk of radiation. Therefore, we investigated the numbers of performed CT scans in emergency department at our institution during the COVID-19 pandemic in comparison to same period of the previous year.

MATERIAL AND METHODS

This retrospective study was approved by the local clinical research ethics committee and conducted in accordance with the principles set out in the Helsinki Declaration 2008. The first COVID-19 case in our country was confirmed by the Ministry of Health on March 11, 2020. In this country, with the increasing number of confirmed cases the transmission classification of the disease turned into community transmission on April. Therefore, we used April to June timespan to compare CT usages in the emergency department of the hospital between the years of 2019 and 2020. Before CT scan, informed consent forms were obtained from all of the patients. The electronic database of the hospital was used to obtain patient and CT imaging case volume data. Only the adult patients' data were noted and the patients under the age of 18 were excluded. Monthly patient numbers admitted to emergency department, monthly CT imaging case volumes at emergency department, age and gender of the patients underwent CT scans were noted for each year. CT scans were also categorized into four anatomical sites as brain CT, chest CT, abdomen CT and the others. For the year 2020, the patients who underwent CT scans were subdivided into two subgroups according to their symptoms (suspicious and non-suspicious for COVID-19), and of these patients who subsequently had positive reverse transcryptase (RT)-PCR test were noted for each month.

RESULTS

Total admitted patients to emergency department between April to June in 2019 and 2020 were 43,570 and 25,106, respectively. Overall number of patients admitted to emergency department showed 42.4% decrement in 2020. Table 1 and Figure 1 represents monthly numbers of patients admitted to emergency department and their percentage changes in 2019 and 2020.

Among the patients admitted to emergency department, CT was performed in 130 and 1,604 patients in 2019 and 2020, respectively. In 2020, despite the decrease in total number of patients admitted to emergency department, CT utilization was increased more than 12 times compared to 2019. Among the CT performed patients, brain (68.5%) and chest (88.6%) were the most scanned anatomical sites in 2019 and 2020, respectively. Based on couple comparisons for all anatomical sites, there was a significant increase in chest CT utilization in 2020 ($p<0.001$). Figure 2 demonstrates the anatomical site distribution of CT scans in the years 2019 and 2020.

TABLE 1: Monthly numbers and percentages of patients admitted to emergency department in 2019 and 2020.

	CT performed patients	Total number of patients admitted to emergency department	Total number of CT scans
	n (%)	n	n
April 2019	63 (0.44)	14,385	75
April 2020	540 (8.25)	6,549	632
May 2019	37 (0.26)	14,453	43
May 2020	449 (5.84)	7,685	490
June 2019	30 (0.20)	14,862	34
June 2020	615 (5.66)	10,872	673

CT: Computed tomography.

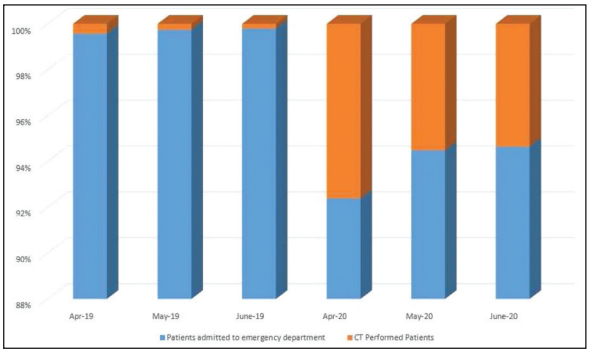

FIGURE 1: Percentage graph of patients admitted to emergency department and underwent computed tomography within April to June timespan in 2019 and 2020.

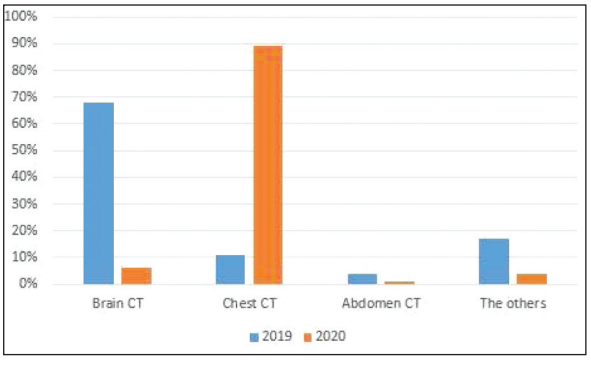

FIGURE 2: Anatomical distribution of performed computed tomography scans in emergency department for the same time period in years 2019 and 2020.

In comparison to 2019, the mean age of CT performed patients was significantly younger in 2020 (53.86±23.44 vs. 43.63±16.62, p<0.001). There was no significant difference between the genders of CT performed patients in 2019 and 2020 (p=0.209). Table 2 represents the number and characteristics of patients who underwent CT imaging.

In 2020, among the CT performed patients, 74.8% (1,200/1,604) were suspicious for COVID-19. Of these patients, 1,193 (99.4%) underwent solely chest CT scans. 7 (0.06%) patients who were suspicious for COVID-19 underwent both chest and abdomen CT scans. In 2019, the rate of pathological findings in chest CT scans was found to be 31.5%, while the rate of typical/suspicious abnormalities for COVID-19 in chest CT scans among suspicious patients was found as 18.6% in 2020. RT-PCR test was performed for all suspicious patients, and of these patients eventually 427 (35.6%) had positive RT-PCR tests.

DISCUSSION

The COVID-19 pandemic affected radiology practices unprecedentedly and still the end of this pandemic remains unpredictable. The findings of the current study can be considered as important because it provides an actual data for CT usages in emergency departments during the pandemic from real world. Although many factors can be associated with urgent CT usages in emergency departments, in this study the differences in same time periods of the two consecutive years are attributable to the pandemic that we are in battle.

The ratio of CT performed patients to patients admitted to emergency department is relatively small in the hospital where the study was conducted. This is very likely due to habits of non-emergent admissions to emergency department in our country.In Turkey, there may be situations such as the annual number of emergency department visits exceeds the whole population.[9]

TABLE 2: Characteristics of patients who underwent computed tomography imaging.

	Age							
		95% CI						
		Mean	Lower	Upper		Gender		
	Mean±SD	difference	limit	limit	p value	Female (%)	Male (%)	p value
April 2019	52.37±21.69	9.74	4.12	15.36	0.001	29 (46.0)	34 (54.0)	0.436
April 2020	42.63±15.96					221 (40.9)	319 (59.1)	
May 2019	51.78±24.42	8.55	0.27	16.83	0.043	10 (27.0)	27 (73.0)	0.055
May 2020	43.24±16.93					194 (43.2)	255 (56.8)	
June 2019	59.57±23.44	14.76	5.91	23.60	0.002	13 (43.3)	17 (56.7)	0.370
June 2020	44.81±16.92					318 (51.7)	297 (48.3)	
April 2019-May 2019	53.86±23.44	10.23	6.17	14.29	<0.001	52 (40.0)	78 (60.0)	0.209
April 2020- May 2020	43.63±16.62					733 (45.7)	871 (54.3)	

SD: Standard deviation; CI: Confidence interval.

When looking at trends in outpatient emergency department visits in COVID-19 pandemic, it was reported that number of emergency department visits during the pandemic were decreased by half comparing with the previous year in Turkey.[10] Our findings regarding with total number of patients admitted to emergency department were also consistent with the aforementioned study (2019 year, n=43,570; 2020 year, n=25,106). We think that people admitting to emergency department with health problems that really require urgent care and delaying their admission to the hospital due to the fear of hospital transmission is effective in this sharp decrease.

Our study revealed that during the COVID-19 pandemic overall CT usage in the emergency department showed a steep increment in comparison to same time period of the previous year. Furthermore, while the majority of the CT performed patients in emergency department underwent brain CT scans (68.5%) in 2019, chest CT (88.6%) has become the most examined anatomical site in 2020. Because the disease mainly affects respiratory system and the role of chest X-ray in the diagnosis is limited, clinicans frequently refer their patients to chest CT imaging. In the current study, among the patients who underwent chest CT during the pandemic, 84.4% were suspicious for COVID-19. At the beginning of this outbreak, several studies reported that chest CT has a high sensitivity even better than initial RT-PCR test in the diagnosis of COVID-19.[11-13] This was very important for early detection and limiting spread of the disease especially in the regions where testing kits are not available sufficiently or turnaround times are lengthy. One recent study also reported that combination of chest CT and RT-PCR test was used succesfully as a diagnostic tool in suspicious COVID-19 patients.[14] Therefore, potential role of chest CT in the diagnosis of COVID-19 enhanced its usage. Additionally, this pronounced increase might have been the result of that is one of the first-step diagnostic methods recommended by the Turkish Health Minister Algorithm for COVID-19. In the light of these facts, a sizeable increase in the numbers of performed chest CT scans can be considered as a foreseeable condition. However, it should be kept in mind, a normal chest CT does not indicate a disease free individual, and Fleischner Society and American College of Radiology clearly stated that CT should not be used for screening or diagnosis of COVID-19 patients.[15,16] The concerns about radiation exposure to patients, possibility of disease spread, locally lacking of personel protective equipments for healthcare workers, and requirement of CT imaging room disinfection before subsequent patients led a recommendation for reserving chest CT for clinically indicated patients. Obviously, it is a difficult condition to handle and the clinicians who work at emergency units unavoidably require additional informations provided by imaging for the management of suspicious patients.

Another important point worth mentioning is the RT-PCR test positivity rate among the CT performed patients. In the current study, 427 of 1,200 (35.6%) patients eventually had positive RT-PCR test. In a study from Italy, RT-PCR test positivity was obtained in 39% of CT performed suspicious patients.[17] Our results are in line with the results of that study and this finding indicates that during the COVID-19 pandemic, most of the CT performed patients are not infected with severe acute respiratory syndrome-coronavirus-2. Although this percentage largely depends on the disease prevalence and may show wide variations among different regions it is important to demonstrate harmful effects of unnecessarily acquired CT scans on public health. If we consider that there have been more than 34 million globally confirmed cases so far, the potential magnitude of scanned RT-PCR negative patients may be tremendous.

Our study revealed that during the COVID-19 pandemic, younger patients underwent CT imaging compared with 2019. This is also an important issue for public health particularly for the future. It has been reported that ionizing radiation can result in genomic rearrangements that may contribute to development of carcinogenesis.[18] If exposure to radiation occurs at younger age, radiation induced tumors will have more time to develop and progress. Therefore, exposure to radiation at younger ages during this pandemic may cause increased incidence of cancer in the future.

This study has several limitations. First, the COVID-19 pandemic still continues. Therefore, the represented data in the current study includes only a time frame from the pandemic, and when the pandemic ends, the future studies that covers whole time period of the pandemic will be valuable. Second, this study includes the data of a single center. Thus, these results may show variations in regions with different disease prevalence and the generalizability of these findings may be limited. However, we think that this study may illuminate how CT usages change in one of the different aspects of the pandemic.

CONCLUSION

In conclusion, our study revealed that during the COVID-19 pandemic CT usages increased, a higher rate of chest CT was performed and younger patients were scanned in emergency department compared with 2019.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

All authors contributed equally while this study preparing.

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