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UNSPECIFIED

REVIEW

COVID-19 radiology CT personnel management

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ABSTRACT

A new coronavirus outbreak called COVID-19 started in December 2019. In Turkey, the first case was reported on 10 March 2020. In this article, information will be given about the patient and staff management and organization that we have implemented in the Radiology Department of our hospital during the COVID-19 pandemic. The rules we followed were: 1- Performing the examinations of COVID-19 patients and suspects with a CT device isolated from other patients; 2- Reducing the unnecessary workload in imaging modalities other than CT, emergency radiography, and emergency ultrasonography; 3- Directing and managing patients and their relatives in accordance with the mask and distancing rules; 4- Disinfecting the device with an appropriate disinfectant after each patient in order to prevent cross-contamination; 5- Protecting the entire technician team from infection by employing one week work, two weeks off shifts of fixed teams; 6- Ensuring adequate ventilation of the gantry room. Adhering to the above rules, no infection spread was reported from the Radiology department and especially the COVID-19 CT unit.

In December 2019, a new coronavirus outbreak called COVID-19 was reported in China (1). On March 11, 2020, the World Health Organization (WHO) announced that it became a pandemic (2), and the incubation period of the disease was reported to be in the range of 2 to 10 days (3). Later, it became evident that the virus caused a highly contagious disease by transmitting from person to person through respiratory droplets and from surfaces contaminated with the virus (4–6), and that the incubation period can vary between 1 and 19 days (7). In Turkey, the first case was detected on 10 March 2020. The National Coordination Board also convened on the same day. Like most countries, our country has set targets within the framework of the following strategies in combating the epidemic. These strategies are: 1) slowing and halting disease spread, preventing epidemics and delaying the spread; 2) providing optimized care for all patients, especially those with severe diseases; and 3) minimizing the impact of the epidemic on health systems, social services and economic activity (8). After the coordination board meeting, a series of measures were taken by the Ministry of Health in our country to prevent the spread of COVID-19. In this context, by using all media channels in our country, both the public and the health personnel were informed about the disease; announcements were made about the hygiene rules and trainings were started. Those with a travel history abroad were quarantined for 14 days, even if they did not have symptoms of the disease. If symptoms occurred in these individuals, possible case management algorithms were applied (9). Like all institutions, pandemic committees have been established in our hospital and necessary measures have been taken. While only preventive measures were taken to limit the spread of COVID-19 in non-healthcare-related institutions, the planning in hospitals is not one-sided, and requires multi-directional and comprehensive planning. All diagnostic and treatment-related services in hospitals should be reorganized to prevent the transmission of the virus from patient to patient, patient to patient relatives, patient to staff and staff to patients. In this context, serious changes need be made in the management of patients and personnel to ensure the continuity of work in the Radiology departments throughout the epidemic. In other words, while providing services to COVID-19 patients, the risk of transmitting the disease to other patients and staff should be minimized (10). In this article, we summarize the patient and personnel management and organization that we have implemented in the Radiology Department of Ege

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Table 1. Radiology department unit planning in Ege University Hospital

	Imaging modalities	Planned use
Radiological Units		
Non-COVID-19	Mammography	Only required patients
	Pediatric radiology	Only required patients
	MRI	Only required patients
	DSA	Only required patients
	DR	Non-COVID-19 emergencies and only required patients
	US	Only required patients
	CT 1	Non-COVID-19 emergencies
	CT 2	Only inpatients and required outpatients
COVID-19	DR	Only COVID-19 patients and on-site radiography with portable x-ray machine
	US	Only COVID-19 patients
	CT 3	Only COVID-19 patients

MRI, magnetic resonance imaging; DSA, digital subtraction angiography; DR, direct radiography; US, ultrasonography; CT, computed tomography; COVID-19, coronavirus disease 2019.

University hospital during the COVID-19 outbreak.

COVID-19 radiology department management

Radiology department is an important health system component that provides diagnostic imaging support to other specialties in every field and also provides interventional expertise support to all branches for many inoperable cases. As of March 10, when the COVID-19 pandemic started to appear in our country, our pandemic hospitals were established within the framework of the strategies determined by our Ministry of Health. Subsequently, the COVID-19 healthcare institutions guideline and the infection control document in Radiology units were published (11). Accordingly, radiology clinics had to change the patient and personnel management in accordance with the COVID-19 pandemic (Table 1). Our hospital has also published additional sub-decisions regarding the COVID-19 radiology algorithm, radiological findings and the use of CT, together with the decisions of the COVID-19 hospital board (12). Within the framework of these decisions, the management and responsibilities of the hospital and radiology departments were determined (Table 2). In the radiology department, patient intake has been minimized in all units except emergency radiography and CT units. Patient recruitment was minimized and all technicians in other units were directed to the CT unit and a team of 40 technicians was formed.

Main points

- Radiology personnel must be protected and work continuity should be ensured during the COVID-19 pandemic.
- Cross-contamination from radiological device surfaces should be prevented.
- Other staff and patient relatives should be protected.
- Clean air exchange should be provided in radiological examination chambers.

COVID-19 radiology CT personnel management planning

PCR test, chest radiography and thorax CT examinations that provide advanced and detailed information are performed for possible COVID-19 patients (13). With the help of PCR tests and mobile radiography devices, chest radiographs of these patients can be performed in the COVID-19 monitoring unit. However, since the CT device is not mobile, patients need to come to the CT unit, which necessitates implementing a series of protection measures (14). The following protection measures were implemented.

1. Dedicated CT device for confirmed and suspected COVID-19 patients, isolated from other patients

We have allocated the CT device closest to the emergency room COVID-19 reception unit only to COVID-19 patients. We reserved one of our other two CT devices in our center for non-COVID-19 emergency patients, and the other for inpatients and outpatients as deemed necessary (14). As COVID-19 and non-COVID-19 patients were examined on separate devices, possible transmission was prevented. We operated our CT devices on a 24-hour basis. With one device, an average of 50 or more COVID-19 patients were screened per day (14).

2. Reducing unnecessary workload in imaging modalities other than CT, emergency radiography and emergency ultrasonography

Examinations of the patients hospitalized and deemed necessary in other imaging modalities were performed with standard preventive measures, and routine control examinations were delayed (15). Other non-technician radiology personnel were employed for one week and then isolated at home for the following week and transferred to the flexible working system (14). Possible contamination has been prevented by reducing the number of unnecessary personnel, patients and patient relatives in the radiology department.

3. Directing and managing patients and their relatives in accordance with the mask and distancing rules

Examinations in all imaging units were performed in accordance with the protection rules. Especially in COVID-19 CT,

Table 2. Radiology department management organization planning and responsibilities

	Management steps	Members	Activities	Responsibilities
Ministry of Health	Hospital management	Chief Physician and the Pandemic Board	Determination of hospital COVID-19 rules	Making announcements using digital social media, providing the necessary training and organization
	Radiology Department management	Head of Radiology Department, Department Faculty Members and Chief Nurse	Application of hospital COVID-19 rules in the Radiology Department	Providing the necessary in-unit COVID-19 trainings and making visits and checks twice a day including the weekend
	CT unit management	Head of Radiology Department and Chief Radiological Technologist	Application of COVID-19 rules in CT imaging	Elimination of personal and technical problems in COVID-19 CT applications

CT, computed tomography; COVID-19, coronavirus disease 2019.

Table 3. Radiology department COVID-19 unit staff organization and protective measures

	Type of staff	Personal number	Activity	Personal protective equipment
Radiology department COVID-19 groups	Radiologist	1	Ultrasonography examination, radiographic and CT evaluation	N95 or FFP2/3 mask Gown Gloves Eye protection (goggles or face shield)
	Radiological technologist	3	Patient positioning and CT scan (one positions the patient with protective clothing, the second one performs CT scan and the third one is patient organizer)	N95 or FFP2/3 mask Gown Gloves Eye protection (goggles or face shield)
	Cleaner	2	Cleaning of patient contact foci after each patient (one cleans the surface of the CT device and the other wipes the floors)	N95 or FFP2/3 mask Gown Heavy duty gloves Eye protection (goggles or face shield)
	Patient and patient relatives		Waiting for diagnostic exams	Surgical mask and gown

emergency radiography and emergency ultrasonography, pandemic rules were meticulously applied. One of the 3 technicians in our COVID-19 CT unit was assigned to direct and manage patients and their relatives (Table 3).

4. Protective clothing for technicians and other personnel dealing with the patient during the CT scan

All technicians and auxiliary staff working in COVID-19 units were given infection prevention training, which comprised subjects such as the rules to be considered in the COVID-19 process and how to perform optimum examinations. The trainings were recorded on video and shared with the help of social media tools. All radiology personnel were dressed in masks, goggles or face shields, gloves and isolation clothes throughout the CT examination (14) (Table 3). Controls and visits were made to the relevant units at least twice a day, including the weekend, by the head of the department, the head nurse and the chief technician. Problems were detected on spot and eliminated, wrong applications were corrected, and necessary materials were distributed.

5. Disinfecting the device with a suitable disinfectant after each patient in order to prevent contamination

Especially in COVID-19 CT, the possible contact surfaces of the device were wiped with appropriate disinfectants after each patient and disinfected. There were two cleaning staff at each shift: one wiped the relevant contact surfaces of the CT device (e.g., gantry, patient table, automatic injector) with an alcohol-based rapid surface cleaner (containing 40 g ethanol, 10 g propanol, 0.25 g didecyldimethylammonium chloride in 100 g solution) after each patient, while the other staff wiped the CT gantry room floors using floor and surface disinfectant (solution containing 7.8% alkyl dimethylbenzyl ammonium chloride, 3.8% didecyldimethylammonium chloride). This solution is diluted as 5 cc active substance in 1 liter of water for routine use, and 20 cc active substance in 1 liter of water on surfaces contaminated with patient fluids (e.g., blood, vomit, feces). A 5 min wait after disinfection ensures maximum disinfection, after which the room is ventilated. At the end of this period, a new patient can be examined. In addition, the CT table was covered with a nylon cover and changed after each patient (14). The above-mentioned disinfection procedures take approximately 20–25 minutes between two patients (14). The meticulous disinfection procedure between the patients aims to prevent cross-contamination, as some of the patients suspected of having COVID-19 may turn out to be PCR negative (16).

6. Protecting the entire technician team from infection

Our staff included one chief technician and 3 teams of 13 technicians. Each team had

Table 4. Radiology COVID-19 CT technician work schedule

			March	April				May			
		Radiological technologist	Weeks 4.	1.	2.	3.	4.	1.	2.	3.	4.
CT groups	1.	3	Duty	-	-	Duty	-	-	Duty	-	-
	2.	3	-	Duty	-	-	Duty	-	-	Duty	-
	3.	3	-	-	Duty		-	Duty	-	-	Duty

at least two experienced and one less experienced technician in CT, and one MRI technician who handled cases with emergency MRI indication. Teams worked on shifts of one week at work and two weeks at home isolation (14). In other words, overtime planning was made by applying the 14 days rule to COVID-19 radiology workers (9) (Table 4). Possible contamination follow-ups were also carried out, as possible infection transmission may cause symptoms within 14 days on average. Therefore, the potential contamination of the employee was expected to occur and the spread of the infection was prevented, since contact with other team members was prevented for 14 days if contaminated. Each team was operated in rotation on our devices reserved for COVID-19 throughout the pandemic period. Thus, work flow continuity was preserved intact.

7. Adequate ventilation of the gantry room

All our CT rooms are designed to take fresh air directly from the outside and deliver it from ceiling fans to the room after being filtered, and to discharge the dirty and infected air through the ozone extractors located at the bottom of the room (14). In this regard, the US National Committee on Radiation Protection (NCRP) and Turkey Atomic Energy Authority (TAEK) do not require ventilation with an air-conditioning system (17, 18). However, in most hospitals, CT rooms are located deep within the hospital, with only access to corridors and cannot reach outside fresh air. In many centers around the world, indoor air is circulated with the split air-conditioning system. However, in the COVID-19 period, split air conditioners cannot be operated due to the concern that they may cause possible droplet contamination by circulating the air inside. Thus, radiation chambers should be installed with air-conditioning systems that take fresh air directly from the outside, filter it and give it inside, providing air circulation at least 10 times per hour. In fact, we think it would be appropriate to install a double air-conditioning system as a back up for possible malfunction situations.

Conclusion

In conclusion, in our department we observed no COVID-19 transmission among the employees after the rotation and team work performed intensively and with many technicians during the COVID-19 pandemic process (14). In addition, infection spread from the Radiology department and especially from the COVID-19 CT unit was not reported. We think that the different and strategic personnel management we apply will benefit the pandemic prevention work (14).

Conflict of interest disclosure

The authors declared no conflicts of interest.

References

1. Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020; 382:727–733.
2. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-sopening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. Accessed on March 23, 2020.
3. World Health Organization Situation Report-7, Coronavirus disease (COVID-2019) situation reports.
4. Dong Y, Mo X, Hu Y, et al. Epidemiological characteristics of 2143 pediatric patients with 2019 coronavirus disease in China. Pediatrics 2020; e20200702.
5. Liu YC, Liao CH, Chang CF, Chou CC, Lin YR. A locally transmitted case of SARSCoV- 2 infection in Taiwan. N Engl J Med 2020; 382:1070–1072. [Crossref]
6. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA 2020; 323:1061–1069. [Crossref]
7. Lauer SA, Grantz KH, Bi Q, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med 2020; March 10. [Crossref]
8. Critical preparedness, readiness and response actions for COVID-19. World Health Organization [Internet] 2020. Available at: https://www.who.int/publications-detail/critical-preparedness-readiness-and-response-actions-for-covid-19. Accessed on March 2020.
9. Demirbilek Y, Pehlivantürk G, Özgüler ZÖ, Meşe EA. COVID-19 outbreak control, example of ministry of health of Turkey. Turk J Med Sci. 2020; 50:489–494. [Crossref]
10. Operational considerations for case management of COVID-19 in health facility and community: Interim guidance, 19 March 2020. World Health Organization [Internet] 2020. Cited March 2020. Available at: https://apps.who.int/iris/handle/10665/331492.
11. https://covid19bilgi.saglik.gov.tr/
12. http://hbys.ege.edu.tr/
13. Rubin GD, Ryerson CJ, Haramati LB, et al. The role of chest imaging in patient management during the COVID-19 pandemic: a multinational consensus statement from the Fleischner Society. Chest 2020; 158:106–116. [Crossref]
14. Savaş R. Alternative strategies for CT unit management during the COVID-19 pandemic: a single center experience. Diagn Interv Radiol 2020 10.5152/dir.2020.20313 [Epub Ahead of Print] [Crossref]
15. Ashari MA, Zainal IA, Zaki FM. Strategies for radiology departments in handling the COVID-19 pandemic. Diagn Interv Radiol 30 April 2020. 10.5152/dir.2020.20232 [Epub Ahead of Print] [Crossref]
16. Huang Z, Zhao S, Li Z, et al. The battle against coronavirus disease 2019 (COVID-19): emergency management and infection control in a radiology department. J Am Coll Radiol 2020; 17:710–716. [Crossref]
17. NCRP(1977), "Radiation Protection Design Guideliness for 0.1-100 MeV Particle Accelerator Facilities", NCRP Report No.51, National Council on Radiation Protection and Measurements, Bethesda, Maryland.
18. Türkiye Atom Enerjisi Kurumu, Tıbbi radyoloji laboratuvarlarının havalandırılmasına ilişkin kılavuz, RSGD-KLV-012.