

Management Suggestions during COVID-19 Pandemic for Radiological Technologists

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Abstract

Radiologic Technology is used by the Radiological Technologists (RT) who are called to modify the practical adjustment of the radiography and the Computed Tomography (CT) scanner examinations due to pandemic of corona virus disease 19 (COVID-19). This article aims to inform the RT by describing specifically the personal protective equipment (PPE), the appropriate decontamination means, the protective techniques for stable or non-stable equipment, the advice for patient management inside the radiology units and the patient ward and also rational distribution of spaces and staff members, mainly to the hospital that receive COVID-19 patients. RT move between medium and high risk zones and constitute units of potential in-hospital disease spread. Protective measures have to be strictly respected and working spaces have to be modified to ensure the personal and collective security, according always to the current conditions.

Key points

- RT constitute potentially units of in-hospital spreading.
- Equipment protection and staff managing is required.
- PPE need to be strictly respected.

Keywords: Radiologic technology; COVID-19; Personal protective equipment; X-ray; Computed tomography scanner

Abbreviation: COVID-19: Corona Virus Disease 19; CT: Computed Tomography; ER: Emergency Room; FFP: Filtering Face-piece; ICU: Intensive Care Unit; Min: Minutes; PPE: Personal Protective Equipment; RT: Radiological Technologists; Sec: Second; WHO: World Health Organization

Received: May 17, 2020, **Accepted:** May 29, 2020, **Published:** June 04, 2020

Introduction

On March, 11th 2020 the World Health Organization (WHO) declared the new stem of corona virus Sars-Cov-2 as the pandemic corona virus disease 19 (COVID-19) [1]. On May 1st 2020, they have been reported 4.589.526 confirmed cases and 310.391 deaths in 216 countries worldwide [2]. Fever, intense dry cough and dyspnea are the most common symptoms of the disease, which in some severe cases can progress into a deadly atypical pneumonia [3]. The disease is characterized by high rate of contagiousness, which happens after direct contact through droplets from infected people after sneezing, coughing, but also with indirect contact via transmitter or conductor [3]. Imaging tests, with chest x-rays and computed tomography (CT), are the selected examinations in order to contribute to the diagnosis and to the monitoring of the disease, illustrating alternations to the

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Citation: Koubardas S, Lagomitzis P,
Chatzitzanou I, Lampropoulou E, Kantsos
C, et al. (2020) Management Suggestions
during COVID-19 Pandemic for Radiological
Technologists Health Sci J. Sp. Iss 1: 001.

pulmonary parenchyma [1]. The staff of the radiology department comes into direct contact with suspicious and confirmed cases [4] either inside the imaging room or at the clinics/units such as the Intensive Care Unit (ICU) and Emergency Room (ER), a fact that redefines the radiology department from a medium risk zone of spreading the virus [5] to a high risk one. Proper hand hygiene, the use of the appropriate sanitary masks and uniform, maintaining distances and keeping minimum physical contact with the patients, whenever possible, are the main pillars of protection against infecting and spreading the virus inside the hospital [6,7]. To date, with no effective therapeutic treatment or a vaccine available, as well as the absence of collective population immunity denotes the fact that the whole medical community will have to deal with the pandemic for longtime [8].

Literature Review

COVID-19 pandemic and radiological technologists

Currently worldwide, the health systems operate at least at their full occupancy with the Radiological Technologists (RT) being an integral part treating the pandemic. Because this disease appears to have high infectivity and patients without symptoms have been detected to transmit and spread the virus, the RT are forced to treat every patient as a potential carrier at the radiology departments [3]. Imaging methods are the means to strengthen and to confirm diagnosis and follow-up treatment, therefore RT from the radiology department and the CT, should be considered front line health personnel. The preferred examination for assessing damage extent of the pulmonary parenchyma is the chest CT [9,10], as it is concluded in the diagnostic algorithm of the disease [11]. Plenty of hospitals prefer to use the chest x-ray as an imaging method, almost daily, for monitoring the disease [10]. A separate imaging room needs to be allocated for suspicious and confirmed cases and should also delineate hazard zones [7]. Especially in the ER, the chamber to perform x-rays could take place in specially designated areas such as containers using a portable x-ray machine to patients that can be moved. It is also legitimate for hospitalized patients with COVID-19 to have x-rays while they remain in their beds, as this is a fast, immediate and satisfactory way to monitor the disease and at the same time to reduce the risk of in-hospital spreading [12].

Means of personal protection and equipment

Applied rules of personal protection, antisepsis and decontamination are essential [13] among patients and RT and also among colleagues. RT should wear the appropriate personal protective equipment (PPE) and have limited contacts. With the beginning of the shift it is recommended to remove any jewelry and to put on hospital clothing and shoes. Also, during the conduct of any imaging examination, double single-use gloves should be used and if it is possible long sleeve gowns to cover the hands over the wrists, cap and surgical mask, while the high protection mask N95 type or filtering face-piece 2/3 (FFP) is necessary in the presence of suspicious or confirmed cases, along with protection glasses or face shield, feet protection and protective uniform [12,13]. Especially, in suspicious or confirmed cases the careful discarding

of PPE components and their immediate replacement is required to prevent any contaminants spreading risk [14,15]. As healthcare workers can usually visit different hospital departments for x-ray diagnostic procedures in the patient wards, they form possible in-hospital spreading units, especially in hospital that non received COVID-19 patients. Disinfection of equipment is essential and if it is possibly the application of transparent plastic membranes/bags over the equipment namely x-ray tube, buttons, managing console, keyboard, mouse, control buttons of x-rays buckey/table or CT, protective x-ray lead aprons/collars, radiological display system [7] which have to be removed and replaced at least after every shift. RT are necessary to be trained on the proper application and removal of both the protection equipment and PPE, in accordance with local and international directions.

Personnel division

During each shift, in every work station the presence of two RT is recommended to minimize in-hospital disease spreading to personnel and patients. The first RT performs practical application examinations with the assistance of the second. Especially, for the imaging room it is recommended that two RT cover the first half of the shift and the other half by two others [16]. Finally, it is recommended to assign every RT to the same work station for five days and after rest or assignment to a different work station both for spreading avoidance but also for radiation protection. All of the above are evaluated always according to workload, personnel dynamic and department management [7].

Radiological technologists and patients

Equipment preparation should take place before the patients' arrival to the imaging room while the use of digital imaging system is recommended to avoid the use of cassette. All patients should wear a surgical mask. Contacts with cooperative patients require 2 meters distance and oral commands, for example via sound system/megaphone, providing the essential directions required to ensure the correct body positioning and imaging accuracy. Chest x-rays could take place in 2 meters source to image distance because the maximum range of droplets for COVID-19 is estimated to be 1.83 meters [17]. A published study conducted by the health care staff that contributes to the treatment shows that being present in a place with a COVID-19 patient in a distance of less than 2 meters and for at least 10 minutes, exposes them to aerosols [18]. On the contrary, in cases of patients with inability to cooperate practical applications of the RT should be reduced to the absolutely necessary and possibly performed in a shorter time frame. Also, they need to be used double single-use gloves, protective uniform, cap, surgical mask and glasses or face shield, if no touch with the patient is required. In addition, the distance between patients should be at least 1.5 meters and every patient should not be accompanied by any relatives when they arrive to radiology department. Finally, the waiting area of the radiology department should be demarcated with clear boundaries with 2 meters distance between them.

Disinfection measures

After every x-ray operation, disinfection the area, the machines and other materials such as peripheral and fixed imaging room

parts, is required using the appropriate disinfectants [14,19]. These could be solutions of 78-95% ethanol content, with incubation time 30 seconds (sec) to 10 minutes (min) which causes inactivated coronavirus infectivity at least by $5.5\log_{10}$, 2-propanole content 70-100% or 45% 2-propanole and 30% 1-propanole for 30 sec which inactivate coronavirus infectivity by $4\log_{10}$ [20]. Also formaldehyde 0.7-1% with incubation time from 2 to 10 min inactivates coronavirus infectivity at least by $3.5\log_{10}$ [15]. Glutaraldehyde about 2% for incubation time up to 5 min inactivates coronavirus infectivity at least by $4\log_{10}$ [19]. Finally iodised povidone 0.23-7.5% with incubation time from 15 sec to 1 min inactivates coronavirus infectivity at least by $4.4\log_{10}$ [20]. In order for any solution to be effective, the coronavirus infectivity should be more than $4\log_{10}$. Suggested solutions are ethanole, 2-propanole, glutaraldehyde, formaldehyde and iodized povidone [20]. Patients' entrance to the imaging room it is recommended to happen in 2-10 min after disinfection, according to workload and when the appropriate solution has been used to the correct concentration [7,20]. An extra measure recommended, for cassette's, is the installation study about Hydrogen Peroxide Plasma Sterilizer which uses cloud of particles and is an effective and fast method to disinfect materials that are sensitive to temperature and humidity [5], always in accordance with the manufacturer's specifications and after his approval [12].

Radiological technologists apart from imaging room

During examination performing in spaces apart from the imaging room such as the ICU, ER and hospital wards the PPE must still apply. Especially to ICU and ER places with high possibility of virus presence on surfaces and floors [20]. Therefore, extra measures are recommended in these cases such single use uniform and waterproof cape with long sleeves [14]. X-ray lead apron/collar has to be worn under the uniform. Cassette or panel/detector has to be sterilized using the appropriate disinfectants after each patient use. Use of plastic bag with security tape is recommended, which has to be disposed carefully from the second (assisting)

References

- 1 Li B, Li X, Wang Y, Han Y, Wang Y, et al. (2020) Diagnostic Value and Key Features of Computed Tomography in Coronavirus Disease 2019. *Emerg Microbes Infect* 9: 787-793.
- 2 World Health Organization (2020) Coronavirus disease (COVID-19) pandemic.
- 3 Park M, Cook AR, Lim JT, Sun Y, Dickens BL (2020) A Systematic Review of COVID-19 Epidemiology Based on Current Evidence. *J Clin Med* 9: 967.
- 4 Zanardo M, Martini C, Monti CB, Cattaneo F, Ciaralli C, et al. (2020) Management of patients with suspected or confirmed COVID-19, in the radiology department. *Radiography*.
- 5 Rutala WA, Weber DJ (2008) Guideline for disinfection and sterilization in healthcare facilities, 2008.
- 6 Ferioli M, Cisternino C, Leo V, Pisani L, Palange P, et al (2020) Protecting healthcare workers from SARS-CoV-2 infection: practical indications. *Eur Respir Rev* 29.

RT. After every examination the portable x-ray machine must be thoroughly disinfected. Also, when possible, the portable x-ray machine and the work station after the examination and disinfection should be placed in an isolated and locked chamber, accessible only by radiological staff. The same procedure could apply to any place in the hospital where the portable machine requires to be used for example in hospital wards.

Computed Tomography Scanner and air conditioning

As for the CT scanner there is a question raised regarding the use of air conditioning. For its proper operation a cooling system is required in constant use due to achieve the best room temperature. To avoid spreading the virus via the air conditioning, we suggest use with influx of only outdoor air and parallel ventilation system operation or alternatively, air filtration system installation. Finally, in hospitals that do not receive COVID-19 patients, during the CT examination of a suspected or confirmed case, the staff switches off the air-conditioning until after the end of examination. This practice needs to be investigated further in order to gather sufficient data to see its effectiveness against the virus spreading and to detect any potentially negative effects on the CT such as overheating and harm x-ray tube or reduce life time of system.

Conclusion

In conclusion RT is essential part in COVID-19 treatment and for this reason the occupational health and safety should be top priority. Attention needs to be paid in the staff's training for the proper application and the removal of protection equipment and PPE. They sway between middle and high risk zones and that makes them frontline health personnel and also potential units of in hospital spreading. PPE have to be strictly respected on a daily basis to ensure virus spreading. Work spaces have to adapt to operate strictly under the safety requirements of the current conditions and comply with guide personnel and collective safety, due to the uncertain evolution of the pandemic.

- 7 Gutzeit A, Li Q, Matorri S, Li B, Wang L (2020) What can European radiologists learn from the outbreak of COVID-19 in China? A discussion with a radiologist from Wuhan. *Eur Radiol* 1.
- 8 Kissler SM, Tedijanto C, Goldstein E, Grad YH, Lipsitch M (2020) Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period. *Science* 368: 860-868.
- 9 Shen C, Yu N, Cai S, Zhou J, Sheng J, et al. (2020) Quantitative computed tomography analysis for stratifying the severity of Coronavirus Disease 2019. *J Pharm Anal* 10: 123-129.
- 10 Araujo-Filho JDAB, Sawamura MVY, Costa AN, Cerri GG, Nomura CH (2020) COVID-19 pneumonia: what is the role of imaging in diagnosis? *J Bras Pneumol* 46.
- 11 World Health Organization (2020) Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected.
- 12 Rodrigues JCL, Hare SS, Edey A, Devaraj A, Jacob J, et al. (2020) An update on COVID-19 for the radiologist - A British society of Thoracic Imaging statement. *Clin Radiol* 75: 323-325.

- 13 European Centre for Disease Prevention and Control (2020) Personal protective equipment (PPE) needs in healthcare settings for the care of patients with suspected or confirmed novel coronavirus (2019-nCoV).
- 14 CDC (2020) Use Personal Protective Equipment (PPE) When Caring for Patients with Confirmed or Suspected COVID-19.
- 15 Suen LKP, Guo YP, Ho SSK, Au-Yeng CH, Lam SC (2020) Comparing mask fit and usability of traditional and nanofibre N95 filtering facepiece respirators before and after nursing procedures. *J Hosp Inf* 104: P336-343.
- 16 Chun RC, Tan TT, Chan LP (2020) Adapting to a new normal? 5 key operational principles for a radiology service facing the COVID-19 pandemic. *Eur Radiol* pp: 1-4.
- 17 Kooraki S, Hosseiny M, Myers L, Gholamrezanezhad A (2020) Coronavirus (COVID-19) Outbreak: What the Department of Radiology Should Know. *JACR* 17: 447-451.
- 18 Ng K, Poon BH, Puar THK, Quah JLS, Jia Loh WJ, et al. (2020) COVID-19 and the risk to health care workers: a case report. *Ann Intern Med* pp: L20-0175.
- 19 European Centre for Disease Prevention and Control (2020) Interim guidance for environmental cleaning in non-healthcare facilities exposed to SARS-CoV-2.
- 20 Kampf G, Todt D, Pfaender S, Steinmann E (2020) Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Inf* 104: 246-251.