

# Management of a diagnostic radiology department amid Coronavirus disease-19 (COVID-19) pandemic

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## Abstract

Severe acute respiratory syndrome coronavirus-2 (SAR-CoV-2) is a highly contagious infectious disease and spreads through aerosols and fomites. Health care personnel who are at the forefront of the fight against coronavirus disease-19 (COVID-19) pandemic are also at greater risk of contracting the infection. Mixing of uninfected people with infected people is potentially hazardous, especially in a radiology department. Implementation of meticulous operational changes, curtailment of nonurgent radiological work, rationalization of staff, equipment disinfection, use of personal protection equipment, and psychological support are needed to combat COVID-19 or any such infectious disease outbreak. This technical note will familiarize radiology workers with infectious disease outbreak-response to be adopted to ensure the safety of staff and patients.

**Key words:** COVID-19; management of radiology department; personal protection equipment; SARS-CoV-2

## Introduction

Humanity is going through extraordinary times since the pandemic of coronavirus disease (COVID-19) emerged in Wuhan, China and spread rapidly across the world. Health care personnel who are at the forefront of the fight against COVID-19 pandemic are at greater risk of contracting the infection. According to available statistics, 41.3% infections in China were acquired in the hospitals of which 29% was hospital staff and rest 12.3% were in-patients.<sup>[1]</sup> In another report of 44672 cases from china, 1716 were health care workers (3.8%) contracted the infection among which 14.8% had a critical or severe illness with five succumbing to the disease.<sup>[2]</sup> Data from National

Health Commission of China shows that more than 3300 health-care workers contracted the infection till March and by the end of February at least 22 had died. Twenty percent of health-care workers were infected in Italy and some have died. Medical staff has also been reporting mental exhaustion and psychological torment resulting from pain of losing patients, concerns for personal safety and anxiety about passing the infection to their families.<sup>[3]</sup> A radiology department can act as a potential source of infection to health care workers or uninfected patients in the current circumstances.<sup>[4]</sup> Prudent management of a diagnostic

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radiology department is essential in limiting transmission of disease to health care workers or other normal patients visiting a radiology department. Based on the available World Health Organization (WHO) recommendations and the response of our own department to COVID-19 outbreak, we aim to present an overview of how to manage a radiology department amid coronavirus crises or any such novel infectious disease in future.

## Discussion

### Management of staff and patients

Soon after receiving the news of first imported case of COVID-19 in our state, our department made a presentation on COVID-19 to familiarize the whole staff about various aspects of this infectious disease including mode of transmission, preventive strategy, and the challenges that lay ahead. The staff was acquainted about personal protective equipment (PPE) and a short demonstration regarding donning and doffing of PPE was also circulated to every member of the department. A robust action plan was formulated and forwarded to every staff member through social communication portals. Instructions are disseminated at regular intervals to the staff using available communication portals.

Nonurgent radiological procedures were postponed to avoid exposure of uninfected patients and their attendants and same was conveyed to the patients. Few doctors were designated to provide teleconsultations to many suitable patients. These doctors actively communicate with patients using social media portals where people are encouraged to ask questions regarding many pertinent health issues and attempt is made to prevent avoidable patient visits to hospital. Staff was divided into groups with the objective to limit intermixing of staff so that uninterrupted radiology services are delivered in case any member of a group gets infected and needs quarantine. It also helps in the preservation of PPE. Information was circulated to all medical departments that patients who are confirmed or suspected COVID-19 and require a radiology examination must be vetted to the radiology department beforehand so that the radiology staff will remain prepared and this will reduce the time patient spends in radiology department, thus reducing the chances of transmission of infection.

Portable radiography and ultrasound were dedicated for use in isolation ward to limit transportation of patients in and out of isolation ward. Chest radiography and point of care ultrasound (POCUS) is used in COVID-19 patients to aid in diagnosis, help in triage and risk stratification, and eventually assist in follow-up of these patients.<sup>[5,6]</sup> Radiographers and radiologists performing radiography or ultrasonography are fully equipped with PPE consisting of tight-fitting N95 respirator, goggles, head cover, face shield, water-resistant gown, shoe cover, and sterile rubber gloves. After

performing the examination, the table is cleaned with 75% ethyl alcohol or 2000mg/L chlorine-containing disinfectant solution. Thorough cleaning of each part of machine with a virucidal agent is essential before reuse. It is ideal to keep a portable ultrasound and X-ray equipment reserve for confirmed or suspected COVID-19 patients. This will circumvent unnecessary transport of patients in and out of isolation ward. The equipment must be stored in a designated room in the immediate vicinity of COVID-19 isolation ward. The examiner performs the test using proper PPE.

There is growing emphasis on the use of portable X-ray and ultrasonography. However, computed tomography (CT) may still be needed in some cases making transfer of patient to CT suite inevitable. All patients with confirmed or suspected COVID-19 who need CT are transferred in accordance with approved guidelines. Patients are transferred with a face mask to minimize the contamination of narrow alleys and closed spaces. This is especially necessary for coughing or sneezing patients as the aerosols generated during transit can remain suspended in air for hours and act as potential source of infection.<sup>[5]</sup>

The radiology staff can be divided into two categories. Those who come in direct contact with the patient and include the imaging technologist/radiographer who positions the patient within the CT gantry. The radiographer who operates the console room does not directly come in contact with the patient. Staff members who come in direct contact with the patient have the highest risk of contracting infection and should follow level-third protection standards strictly in accordance with the laid guidelines. This entails wearing a protective cap, N95 respirator, face shield, goggles, waterproof protective gown/clothing, sterile rubber gloves, and shoe covers. They should do well both in wearing and removing the PPE. Patient must wear a mask before setting up on the CT gantry. Patient should be encouraged to engage in minimum conversation.<sup>[6,7]</sup> CT table is covered with a single-use disposable polythene sheet or a soft cloth sheet soaked in chlorine-based disinfectant solution with chlorine concentration of 2000mg/L. Alcohol with a concentration of 75% can also be used. If single-use disposable sheets are not available, then table sheets can be placed in a virucidal disinfectant solution (e.g., 0.1% sodium hypochlorite) before reuse.<sup>[8]</sup>

### Recommendations regarding the type of mask to be used

WHO and the latest scientific evidence suggest that surgical masks may be used as a suitable device to protect healthcare workers.<sup>[9]</sup> However, any aerosol-generating procedure (intubation, cardiopulmonary resuscitation, tracheostomy, and bronchoscopy) would warrant use of high filtration masks (N95/99, FFP2/3 or equivalent).<sup>[10]</sup> Table 1

**Table 1: Requirement of personal protection equipment (PPE) for healthcare staff**

	Basic requirements	Suspected COVID-19 patient	Confirmed COVID-19 patient
Surgical mask	Yes	Yes	Yes
Surgical cap	Yes	Yes	Yes
Gloves	Yes	Yes	Yes
Eye protection (goggles/visor)	-	Yes	Yes
Waterproof gown	-	Yes	Yes
Shoe cover	-	Yes	Yes
Medical mask (FFP2 or higher)	-	-	Yes

FFP: Filtering face piece

summarizes requirement of various personal protection devices while dealing with patients. The staff must be educated on donning and doffing of PPE. Given the supply constraints, rationing and judicious use of available PPE is essential.

#### Disposal of used personal protective equipment and other waste products

All the articles and wastes are treated as clinical infectious waste category B and immediately discarded.<sup>[11]</sup> After the examination is over, the disposable personal protection articles and disposable table sheet are removed and thrown into the provided medical waste bins with double garbage bags and tight lids. All the discarded articles and waste products must be transported in a sealed manner and later incinerated in accordance with contaminant treatment regulations.<sup>[12]</sup> Staff involved in waste management should wear PPE.

#### Disinfection of equipment and imaging room

62%–75% ethanol reduces infectivity of SARS-CoV-2 by 3 to 4 times after a contact period of 1 minute. Sodium hypochlorite (NaClO) solution in a concentration of 0.1%–0.5% reduces the infectivity of virus by 3 times after contact period of 1 minute. 2% glutaraldehyde and 0.5% H<sub>2</sub>O<sub>2</sub> is equally efficient and reduces infectivity by 3 times after 1 minute of contact time. Other agents effective against SARS-CoV-2 are propan-1-ol and propan-2-ol.<sup>[8]</sup> The CT gantry table is wiped with a soft cloth soaked in chlorine-based disinfectant solution with a chlorine concentration of 2000mg/L after every use. Alternately 75% ethyl alcohol can be used to clean the gantry table. When alcohol is used, the table will air dry naturally. However, a routine CT machine not dealing with suspected or confirmed COVID-19 patients can be cleaned with chlorine-based disinfectant solution with a chlorine concentration of 1000mg/L or 75% alcohol solution at least 3 times a day. Liquid spray disinfectant solutions should not be used to disinfectant the CT machine as the disinfectant vapors can penetrate into the equipment and cause short circuit or corrosion.<sup>[13,14]</sup> Floor of CT

room should be wiped with chlorine-based disinfectant solution with concentration of 2000mg/L at least 4 times a day. Frequently touched contact surfaces like operating console, keyboards, tabletops, switches, door handles doorknobs, and chairs and armrests are cleaned with a cloth soaked with alcohol-based disinfectant.<sup>[8]</sup> Alternately sodium hypochlorite solution can also be used. Room air disinfection can be carried by using negative pressure ventilation. In case of its unavailability, fresh air ventilation for a period between 1 and 3 h should suffice. If windows of imaging room do not open (closed-circuit ventilation), high-efficiency particulate air filtration should be used to recycle air.<sup>[4]</sup>

#### Psychological counseling

A surge in patient load, long work shifts, fear of catching the disease, inability to visit home has taken a toll on health care workers across the world. Health care professionals are liable to emotional and mental breakdown under these dire circumstances. Measures must be taken to reassure and decompress the staff. In our hospital, the senior faculty engaged in active communication with all the resident staff and technologists and kept reassuring them. This constant positive reinforcement allayed many anxieties of the staff. Those staff members who were apprehensive about going home were provided accommodation in a nearby hotel which was empty. Efforts must be made to allow adequate rest, sleep, and good diet. Encouraging the staff to seek social and family support by allowing frequent telephonic communication proves beneficial. Some might need help of a professional psychologist to keep negative emotions at bay.<sup>[3]</sup>

#### Conclusion

Swift operational planning, segregation of staff, information dissemination, familiarity with proper use of personal protection equipment, use of portable imaging, disinfection of equipment, infectious waste management, and morale boosting of staff to outlast a sustained outbreak are essential for safe delivery of radiology service during contagious disease outbreak.

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#### Conflicts of interest

There are no conflicts of interest.

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