



EDITORIAL

COVID-19 Pandemic and Radiology: Facts, Resources, and Suggestions for Near-term Protocols

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Introduction

The purpose of this editorial is to offer a synopsis about the COVID-19 pandemic and to present some recommendations as they relate to the practice of radiology, focused on Low- and Middle-Income Countries (LMIC). Health departments and professional bodies around the world are issuing guidelines for personal protection and patient handling in radiology. In High-Income Countries (HIC) these guidelines have been periodically updated as knowledge evolves about COVID-19 viral disease (1,2,3). The HIC guidelines assume the availability of portable radiography, ability to reserve one of many CT scanners only for COVID-19 patients, supply of a whole range of personal protective equipment (PPE), sanitizers and a variety of disinfecting chemicals. Nevertheless the exponential spread of COVID-19 is causing shortages of supplies in regions with supposedly “unlimited” resources. Much continues to be published on the rapidly evolving body of knowledge on this highly contagious respiratory infection, with a much higher mortality compared to the Influenza-A virus responsible for respiratory disease during “flu season” (4). Concurrently, speculative and false information is being exchanged on social media by “experts” from all walks of life offering “science” on the current pandemic. We urge our readers to use resources from established health organizations and universities, many of whom are referenced in this editorial.

Rationing requires that healthcare providers and institutions think about saving total life-years rather than focusing on each individual patient. COVID-19 has strained healthcare systems worldwide and has resulted in actions being taken in HIC that would have been considered unthinkable three months ago. In addition to the life-or-death rationing of ventilators and other critical healthcare resources based on factors such as patient age, notably in Italy, the US Centers for Disease Control and Prevention made the unprecedented suggestion in March 2020 that in healthcare facilities with shortages of PPEs, bandanas or scarves could be substituted for medical facemasks as a last resort (5). We include this description not as an endorsement of suboptimal care and rationing, but as a recognition that LMIC, which have routinely faced the need to ration resources, will face the same painful choices as HIC have in this pandemic, and that difficult decisions and creative solutions will go hand-in-hand in dealing with this crisis.

About COVID-19

COVID-19 is a disease caused by a virus now named SARS-CoV-2. It is a new, highly contagious member of the family of coronaviruses. It is often referred to as Novel Coronavirus, because the virus is new to humans, likely having originated (like SARS-CoV and MERS-CoV) in bats or pangolins, hence the absence of preexisting human immunity. Three factors are primarily responsible for the rapid spread of COVID-19. First, people who are infected can transmit the virus for several days prior to becoming symptomatic. Second, the disease is often not

severe at its onset, so that people can continue to engage in work/social contact. Third, the virus seems more capable of persisting in the human population than SARS (SARS-CoV virus) so that the pandemic is unlikely to burn itself out.

COVID-19 is principally spread by airborne droplets or via contaminated hands touching the face. The reproduction number or degree of infectivity of COVID-19, the R_0 (R-naught), is 3 (1.4-3.9) (6). This means that each infected person, whether symptomatic or not, is spreading the virus to three individuals. If that spread continues unabated through 10 cycles, one person would infect 59,000 people. As a comparison, the Influenza-A Pandemic of 1918 ("Spanish Flu") had an R_0 of 1.8 (1.4-2.8) so that, in 10 cycles, one person would infect only 357 individuals. That pandemic caused 50 million deaths worldwide (6).

Currently, there is no known treatment or vaccine for COVID-19 virus. Supportive care appears to reduce mortality for those with moderate to severe infection. Prevention by containment and transmission reduction are the primary measures to reduce morbidity and mortality. The basis for this strategy is Universal Precautions. It is therefore prudent to assume that every individual is a carrier and any surface they touch is potentially infectious, unless disinfection has been performed.

Imaging guidelines

Policy statements with guidelines for the use of imaging in patients with COVID-19 have been published by both the American College of Radiology (ACR) and the European Society of Radiology (ESR) (7,8). The Radiological Society of North America published on the reporting of chest CT findings related to COVID-19 (9) and, while a proposal for standards in the use of lung ultrasound has been published in the Journal of Ultrasound in Medicine (10), the role of ultrasound in the clinical diagnosis and management of patients with COVID-19 is rapidly evolving.

Neither the ACR and ESR recommend chest X-ray or CT in the initial diagnosis of COVID-19. In the personal experience of the author in days prior to writing this editorial, many radiologists are confirming what was initially reported from Wuhan (10), that on the basis of rounded ground glass opacities in lower lungs, the diagnosis of COVID-19 viral pneumonia can be proposed even if the molecular test is negative. This is particularly important, as RT-PCR (reverse transcription polymerase chain reaction) testing using nasal swabs may have a false negative rate of up to 30% (11). Chest X-ray, ultrasound, and CT can be used in the clinical management of hospitalized patients, although guidelines caution that the use of CT should be selective. Given the rapidity of the pandemic, all the published reports on lung ultrasound are uncontrolled, but there is a subjective consensus that ultrasound's portability, ease of use, and lack of radiation exposure offer advantages in monitoring disease progression and influencing management decisions.

The ACR and ESR guidelines should not be construed as

negating the role of chest X-ray in the management of patients with COVID-19. The guidelines are consistent, to a large degree, with the Basildon Protocol – Diagnostic Imaging Protocol version 2 [United Kingdom], which recommends chest X-ray in high-risk patients and those with severe disease and, if radiographic findings are atypical, recommends the performance of chest CT (12).

Ultrasound, more widely available in LMIC than CT, is showing promise in the diagnosis and management of COVID-19 infection. Ultrasound shows septal thickening (B-lines) and lung consolidation (13). This modality requires familiarity with these findings to make a diagnosis. Readers are urged to read the excellent article by Soldati G. et al, which includes a proposed grading scheme and standardized acquisition protocols (10).

For readers interested in a summary of the imaging findings in COVID-19 and current recommendations for the use of imaging, this journal plans to publish a follow-up article over the next few days.

Best practices for infection control

In departments of radiology, as in daily life in general, "social distancing" and disinfection must be practiced. General guidelines on facility preparation and management have been published by Partners In Health (PIH), in part based on their experience in the Ebola epidemic (14), and RSNA has published guidelines specific to radiology departments (3). To assist radiologists in breaking the cycle of spread and protecting both personnel and patients, what follows are our recommendations based on these guidelines:

- Postpone all non-essential imaging studies once a COVID-19 outbreak occurs regionally. This both avoids the potential for cross-infection to patients and protects the technologist workforce, prolonging their efficacy in an outbreak. It also reduces the strain on supplies, personnel, and facilities.
- Ensure that all radiology personnel are familiar with standard infection prevention and control measures for COVID-19 and the locally available PPE.
- Perform daily attestation checks on personnel regarding any symptomatology including dry cough, fever, new sore throat, anosmia, etc.
- All patients entering radiology should wear masks, and staff should wear masks and gloves. With known COVID-19 infection, staff should use the available Personal Protective Equipment (PPE) including mask, caps, gloves, eye protection, protective gown/overall for clothes, and shoe covers. If masks are not available for both patients and staff, staff should be prioritized both for efficiency and because of their repeated exposure.
- Train and implement standard operating procedures (SOPs) for equipment decontamination and handwashing/sanitization.

- Ensure that adequate resources are available, proximate to radiology, for handwashing (or, if running water is not proximate, hand sanitization).
- Determine if adjacent areas, such as control rooms, etc. can be further separated to minimize the airborne spread of infection using room isolation tarps with zipper access.
- Close off any non-essential spaces adjacent to sites where patients with COVID-19 are imaged.
- Assess personnel and equipment workflow to maximize the available PPE and minimize the interaction between personnel and infected patients, and restrict access to radiology for any non-essential personnel or family members.
- Consult operating manuals or companies as to whether alternative cleaning solutions, such as dilute bleach, can be used on equipment. Such solutions are likely to be more widely available during a crisis than specialized disinfectant wipes. Note that dilute bleach solutions lose their efficacy and should be disposed of after 24 hours.
- Use mobile imaging (radiography and ultrasound), where applicable.
- If more than one piece of imaging equipment is available, consider dedicating one unit to COVID-19 patients, which will reduce the workload and supplies required for decontamination.
- Adequate decontamination of equipment is time-consuming. Imaging workflow for patients with known COVID-19 infection should be distinguished from imaging patients with possible infection. If specific equipment cannot be dedicated to COVID-19 patients, equipment should be utilized first with asymptomatic patients, then symptomatic patients, and lastly with confirmed COVID-19 cases. Patients with confirmed COVID-19 infection can be imaged as a cohort before performing full decontamination.
- If facilities are planning to designate specific areas (fever tents, etc.) to the triage of suspected patients, determine the most effective strategy for associated imaging workup, including mobile imaging.

In the current COVID-19 pandemic, a shortage of PPE exists in HIC. In the United States, emergency measures are being taken to recycle used PPE after sterilization and temporary instructions have been published by the Food and Drug Administration (FDA) to prepare decontamination products (15). LMIC must begin preparations with near certainty that the pandemic will affect their regions. Self-reliance and improvisation will be necessary to fill supply-demand gap for resources required to reduce transmission in healthcare facilities, particularly to healthcare providers. Extraordinary times require extraordinary measures. Measures unthinkable under normal circumstance may be employed during a lethal pandemic. Public participation in sewing masks, caps,

and gowns using recyclable local materials have become common to limit mortality both within and outside hospitals. Previously unimaginable numbers of such products must be produced as nations prepare to deal with the COVID-19 pandemic. Under exceptional circumstances, any materials that can be cleansed with disinfectant solutions, such as raincoats, ponchos, plastic sheets and even clean trash bags may be used for personal protection by staff and patients. A variety of protective gloves are used in healthcare and other industries. Any type of non-porous gloves may be used for protection.

The US-based Food and Drug Administration (FDA) has issued a temporary policy on the production of hand sanitizer and antiseptic alcohol-based products. These can be used for wiping down equipment and countertops and for hand hygiene (15).

The ingredients are as follows:

- Active ingredients: Ethanol 80% volume/volume (v/v) in aqueous solution OR Isopropyl Alcohol 75% v/v in aqueous solution.
- Inactive ingredients: Glycerol 1.45% v/v, Hydrogen peroxide 0.125% v/v, distilled or boiled water.

Proper handwashing with soap and water several times a day is a worldwide practice. In healthcare, handwashing remains the hallmark of infection control. Handwashing with proper technique is pivotal in containing the pandemic. As a reminder, the guidelines are as follows (16):

1. Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
2. Lather your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
3. Scrub your hands for at least 20 seconds by watch. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.
4. Rinse your hands well under clean, running water.
5. Turn off water with foot pedal or using a towel.
6. Dry your hands using a clean towel or air-dry them.

Testing and treatment

Current COVID-19 tests, RT-PCR, are based on amplifying viral RNA from nasopharyngeal swabs. On average, results from this test can take days in the US. With this turnaround time (TAT), the ability to perform millions of tests – necessary in a pandemic – does not exist. Scientists are working on tests with a shorter TAT, and the FDA recently approved a portable, point-of-care test that can deliver a positive result in as little as five minutes (17).

RT-PCR tests can help diagnose current cases of COVID-19,

but they cannot determine whether someone has had the infection and since recovered. Serological testing can detect antibodies present in anyone who has recovered from COVID-19. The FDA has just approved a fingerprick test for antibodies to the SARS-CoV 2 virus (18) and one US-based company is already shipping their fingerprick test to countries outside the US while FDA approval is pending (19).

Scientists around the world are working on drugs and a vaccine for COVID-19 infection. Currently, there is no vaccine against COVID-19, and the widespread production of a vaccine is unlikely until at least 2021. The utility of antimalarial drugs, antiviral drugs, and BCG inoculation have been proposed to fight the pandemic but there are, as yet, no conclusive studies. Experts, such as Jerome Grossman, caution about the widespread use of untested therapies (20).

Conclusion

While we hope that this information helps in preparation and action for the COVID-19 pandemic, new information about COVID-19 is being added on a daily basis. Readers are therefore urged to frequently check reliable sources for the latest knowledge about the pandemic: departments of health in their own countries, the World Health Organization (WHO), US Centers for Disease Control and Prevention (CDC), American College of Radiology, Royal College of Radiologists, and European Society of Radiology (1,2,21-23).

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