

Strategies for radiology departments in handling the COVID-19 pandemic

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ABSTRACT

The world is facing an unprecedented global pandemic in the form of the coronavirus disease 2019 (COVID-19) which has ravaged all aspects of life, especially health systems. Radiology services, in particular, are under threat of being overwhelmed by the sheer number of patients affected, unless drastic efforts are taken to contain and mitigate the spread of the virus. Proactive measures, therefore, must be taken to ensure the continuation of diagnostic and interventional support to clinicians, while minimizing the risk of nosocomial transmission among staff and other patients. This article aims to highlight several strategies to improve preparedness, readiness and response towards this pandemic, specific to the radiology department.

The coronavirus disease 2019 (COVID-19) outbreak has been declared a global pandemic by the World Health Organization (WHO) (1), causing unprecedented strain on all aspects of life, especially healthcare systems. At the time of writing, there are already more than 1.7 million confirmed cases worldwide, with the United States of America accounting for one third of those cases. The worst-case scenario from a public health perspective is an overwhelming number of patients getting infected by the virus, leading to collapse of healthcare services.

Although policies and strategies in handling this crisis vary between countries and institutions, there should be synchronized objectives to: 1) slow and stop transmission, prevent outbreaks, and delay spread; 2) provide optimized care for all patients, especially the seriously ill; and 3) minimize the impact of the epidemic on health systems, social services, and economic activity (2).

The radiology department is an essential component of the healthcare system in providing diagnostic imaging and interventional expertise to other specialties. Due to the unpredictability of the situation, drastic changes must be taken to ensure that the department continues to function throughout the course of the outbreak, catering for both COVID-19 and other patients, while minimizing the risk of staff contracting the disease. This article highlights some of the strategies adopted by different radiology departments around the world to improve preparedness, readiness and response towards this pandemic (3).

Centralized task force

Many institutions and hospitals have formed centralized task forces at multiple operational levels to handle this crisis (4). At the radiology department level, roles of this task force include:

- Setting up department policies, strategies and developing standard operating procedures (SOP) based on local, national, and international guidelines.
- Keeping up to date and making necessary adjustments based on the latest information available.
- Effective dissemination of information from higher authorities to all working staff.
- Ensure optimal working manpower to run services smoothly.
- Consider work from home arrangements for radiologists and support staff if possible, such as providing home workstations and utilizing video conferencing software for meetings.

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- Offer psycho-social support to prevent burnout and low morale among staff.
- Liaising with occupational healthcare services for testing, treating, and quarantine of staff who are exposed to the virus either from the community or healthcare setting.
- Clear chain of command in case any member of the task force and their contacts are forced into quarantine.
- Consider scaling down services when faced with limited human resources or equipment with more focus on critically ill patients.

Infection precautions

Human-to-human transmission via droplets and contact has been established as the main mode of transmission for the COVID-19 (5) with basic reproductive numbers (R_0) estimated to be around 2.24 to 3.58 (6). Precautions usually depend on potential exposure hazards but viral shedding by asymptomatic patients heightens the risks faced by healthcare workers. Policies and SOPs should entail the possibility that all patients and staff can be carriers of the virus, regardless of being symptomatic or otherwise. Strong emphasis on standard droplet precautions like hand washing with soap or sanitizers, cough etiquette and social distancing is crucial to prevent the spread of disease (7).

Rational use of personal protective equipment (PPE) based on risk of exposure and centralization of its distribution can secure longer supply availability. Basic PPE when attending COVID-19 patients or those with respiratory symptoms include surgical

masks, goggles or face shields, gowns, and gloves (8). All staff must be trained on proper donning and doffing of PPEs in order to optimize their usage. Audits may be ensued to guarantee compliance according to the local guidelines.

A common confusion encountered by healthcare workers is the proper use of face masks. Surgical masks have better imperviousness to bodily fluids, so its intended use is to protect other people from the wearer. Hence, patients with respiratory symptoms must comply with the use of surgical masks when in the department (9). N95 respirators on the other hand, provide up to 95% protection from airborne particles but are less protective against bodily fluids. This makes them more suitable to protect the wearer when carrying out aerosol-generating procedures like tracheal intubation (10).

Appointments and waiting area

The Center for Disease Control and Prevention (CDC) advocates rescheduling elective appointments to focus on urgent and emergency cases as one of the steps to enhance preparedness (11). Radiologists can help to vet the urgency of imaging or interventional requests from clinicians so cases can be prioritized as indicated.

Staggered appointments can be applied to avoid large crowds within the department at any particular time. Inpatients who have completed their scans must be sent back to the ward at the earliest moment by liaising with porter services to reduce waiting time at the department.

Other practical measures to facilitate social distancing within the department involve limiting the number of personnel accompanying patients as well as placement of clear signage on the floor in queueing areas and on seats to prevent people from standing or sitting too close to each other.

Movement and traffic

Besides droplet transmission, a recent study by van Doremalen et al. (12) has suggested the plausibility of aerosol and fomite transmission of the novel coronavirus. In light of this information, further initiatives to minimize patient movement such as designation of "contaminated", "semi-contaminated", "buffer", and "clean" working zones to limit cross contamination (13). Dedicated portable X-ray or ultrasound machines can also be placed in wards or intensive care units with COVID-19 patients to reduce the

risk of nosocomial transmission, conserve PPE usage by staff and save time spent on decontamination.

However, if a patient has to come down to the department for a scan, all staff must be alerted beforehand so that necessary preparations can be taken. Dedicated routes for transporting COVID-19 patients need to be planned to lessen contact with staff and other patients. Terminal cleaning of working areas and disinfection of equipment after any exposure must be done according to standard protocol before normal work can be resumed (14).

Screening stations can be set up at all entry points into the department to identify individuals who are symptomatic with the virus. Exposure risk information sheets on travel and contact history may also improve the effectiveness of these screening stations (15). If a person fails the screening, they have to be given clear instructions on the next steps to be taken and redirected to the necessary teams as per local protocols.

Human resource management

Both clinical and nonclinical staff are vital in maintaining smooth operations within a radiology department. All personnel must be educated on the standard infection prevention control measures against COVID-19, in line with local SOP. The worst-case scenario that must be avoided is the collapse of a department when its own staff contracts the disease, leading to closure or scaling down of the department workforce. This may induce a heavy burden on clinicians that rely on radiological expertise to help with patient management.

Rescheduling nonurgent cases can improve the readiness of the department to handle the outbreak as stated before. An optimal number of staff must always be available on site to run the departmental services. Signs can be placed particularly in the working spaces to limit the maximum number of people per space. Furthermore, arrangements can be made by the COVID-19 taskforce for extra bodies to work from home or be on standby, if there are sufficient capabilities to do so.

Many countries have enforced movement control orders to break the chain of transmission of the virus within the community following measures taken by Wuhan, Hubei Province, China, where the disease first broke out (16). Nevertheless,

Main points

- A centralized task force should be formed at the department level to construct policies and strategies in liaison with institutional and international guidelines.
- Rational and proper usage of personal protective equipment, especially by frontline staff, reduces the risk of nosocomial spread.
- Rescheduling elective appointments provides some leeway to consolidate resources and improve preparedness.
- Dedicated machines and satellite imaging units can help minimize patient contact with noninfected personnel.
- Proactive human resource management is crucial to ensure services continue at optimal capacity.

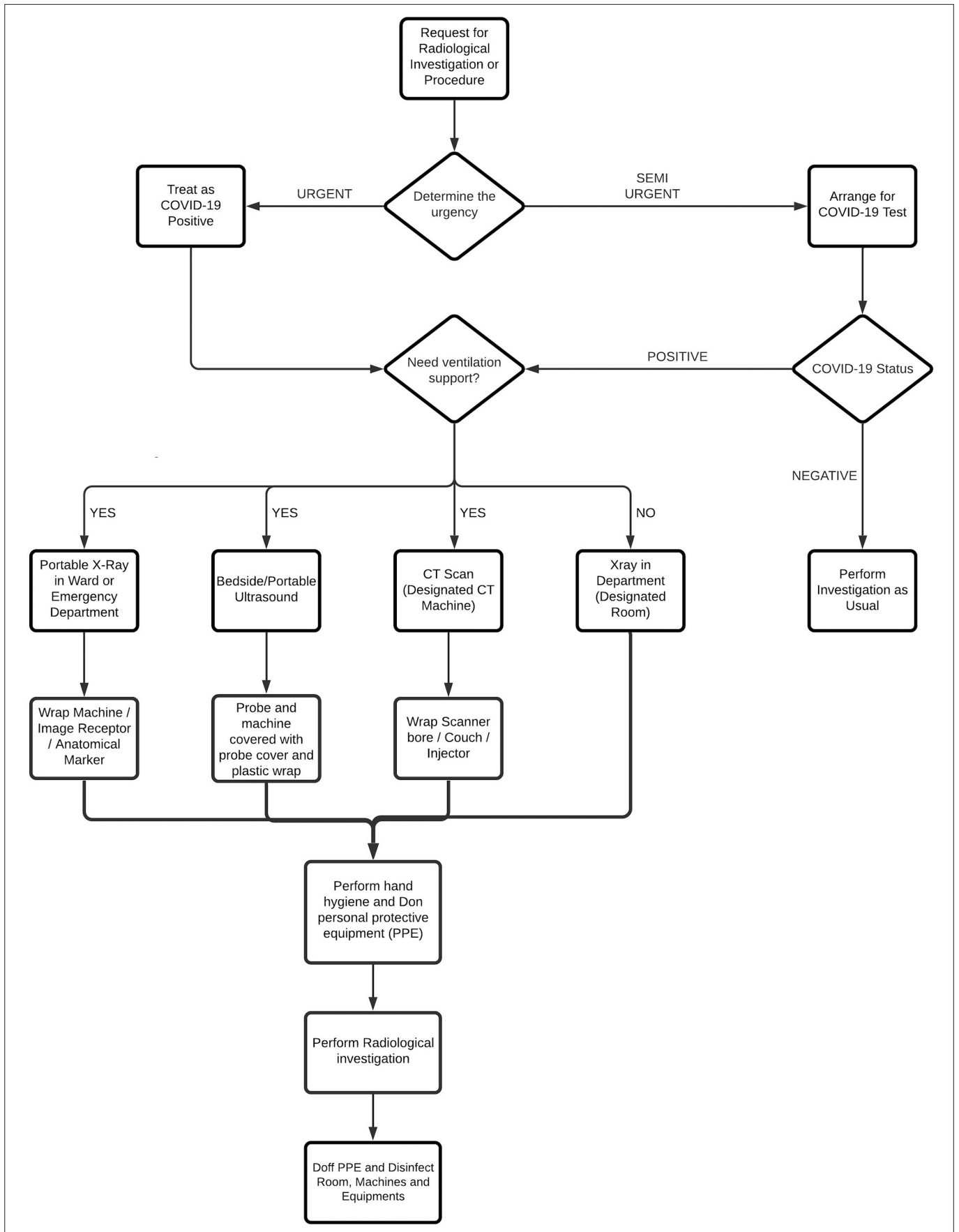


Figure. Workflow example for radiological investigations during the COVID-19 pandemic.

healthcare workers are usually not bound by these restrictions as the health sector must continue functioning to treat patients. There is always the potential risk of healthcare workers spreading the disease from the community into the workplace, so every single person must be responsible in observing the infection prevention control measures, even after official working hours.

Due to the fact that viral shedding occurs even in asymptomatic individuals, all patients and colleagues can be potential COVID-19 carriers. In many instances, the status of the patient may only be confirmed retrospectively after a few days from the actual contact and the healthcare worker may not be wearing full PPE at the time. Therefore, clear guidelines have to be in place for the reference staff who become exposed to potential or confirmed COVID-19 patients. Close communication between the department task force and occupational healthcare services can help mitigate further spread to other personnel. Testing, imposing a quarantine, and providing the necessary treatment can be coordinated as per local protocol.

Strategies for different imaging modalities

A workflow example for radiological investigations to be employed during the COVID-19 pandemic is shown in the Fig.

General radiography

Plain radiographs will be the mainstay imaging study that will be used for COVID-19 patients. Some strategies like designating dedicated portable machines and satellite radiological services, have been alluded to earlier where the main objective is to reduce movement of patients.

The department can assign dedicated radiographers to handle portable X-ray machines per shift to minimize movement and usage of PPEs. Having two radiographers operating portable X-ray machines is also recommended, with only one of them coming in contact with patients while the other remains in the “clean” environment.

Ultrasound and interventional radiology

Healthcare workers who perform ultrasound examinations and interventional radiology procedures have high exposure risk, which can be defined as having face-to-face contact within 2 meters in a closed environment for more than 15 minutes (17).

For this reason, stringent infection prevention control measures and PPE use must be observed. Operators must aim to minimize the time of contact without compromising diagnostic quality and patient care.

Probe covers should be used for all patients if possible. Proper disinfection of the ultrasound machine and examination couch after each patient should be done as per standard protocol. For confirmed or suspected COVID-19 cases, portable ultrasound examinations are preferred.

CT scan

Thoracic CT provides highly sensitive diagnostic value, especially when combined with real-time reverse transcriptase-polymerase chain reaction (RT-PCR) test (18, 19). Nonetheless, the consensus is that CT should only be reserved for certain situations such as guiding management decisions of critically ill patients and monitoring progress of disease (20).

On this account, imaging requests for confirmed or suspected COVID-19 cases have to be sieved on a case-by-case basis. If possible, the study should be delayed till after working hours to reduce the number of personnel coming in contact with the patient. In instances where this is not possible, all staff have to be made aware of any incoming COVID-19 patients so adequate preparation can be done prior, during, and after the scan.

Dedicated machines should be allocated for COVID-19 patients. But when the same machine is meant to be used by all patients, proper disinfection of all equipment including workstations, mouse and keyboards along with terminal cleaning of the CT suite must be done as per standard protocol in between patients (21). Another alternative is the usage of disposable covers if available.

Other imaging modalities

In general, appointments for imaging modalities that usually involve outpatients such as mammography, MRI, fluoroscopy, and nuclear imaging should be postponed or redirected to other hospitals, if possible, so resources can be focused on handling more pressing matters at hand resulting from the COVID-19 outbreak. Standard infection precautions apply if there is a need for these imaging modalities.

Conclusion

In conclusion, the adage, “failure to plan is planning to fail” can never be truer on a global scale at this juncture. Constant

improvements of strategies to handle COVID-19 in tandem with local and international public health measures are hoped to flatten the curve and spread the burden of disease until sufficient herd immunity or an effective vaccine is made available to the masses. In the meantime, proactive measures tailored to the resources of each department need to be carried out so services can run at optimal capacity without jeopardizing the safety of staff and other patients.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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