

Preparedness of Nuclear Medicine Departments during the Severe Acute Respiratory Syndrome-Coronavirus-2 (COVID-19) Pandemic

The novel coronavirus disease-19 (COVID-19) pandemic has reached an unprecedented magnitude with approximately 1 million cases and 50,000 deaths worldwide. The virus has been renamed as severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) due to its similarity to the virus which caused the SARS epidemic of 2003. SARS-CoV-2 is a single-stranded RNA virus with a crown-like appearance. The disease mainly affects the lungs, is highly contagious, and spreads by respiratory droplets and fomites. Currently, real-time polymerase chain reaction is used for confirmed diagnosis with a reported sensitivity of up to 90%.

Health-care systems throughout the world are struggling to cope up with the COVID-19 due to high number of patients requiring isolation and intensive care facilities. The high chances of transmission of infection to health-care workers (HCWs) is a major professional hazard faced by the medical fraternity. Imaging departments including radiology and nuclear medicine are facing major challenges in an effort to continue routine operations, image patients with suspected or proven COVID-19, and ensure the health of workers by providing proper training and equipment to reduce the risk of transmission of infection.

There are limited number of publications on how imaging departments are tackling these issues till date.^[1-6] Most procedures done in nuclear medicine departments are elective and require longer stay of patients in the department compared to other radiology services. In addition, most scanners in nuclear medicine departments are nonportable, requiring shifting of patients to the department for imaging. Radionuclide and radiopharmaceutical supply chains have been impacted. All nuclear medicine departments need to prepare to deal with these challenges. The concepts of "Time, Distance and Shielding," used in radiation protection, are essential in the prevention of the transmission of SARS-Cov-2 infection. In this context, personal protective equipment (PPE) kits provide shielding.

Protection of Staff

Any person coming in close or physical contact with a COVID-19-positive case is at high risk for transmission of the infection. These include nuclear medicine physicians, residents in training, nursing staff, technologists, physicists, hospital attendants, receptionists, security guards and other patients. Ensuring the health of staff is necessary to ensure the maintenance of services. Nuclear medicine department leadership should actively engage with the hospital infection control committee and train staff in respiratory infection control practices, hand hygiene, and proper

donning and doffing of masks and PPE kits. Standard operating procedures (SOPs) should be established and routine audits of infection control practices should be carried out.

Staff members should be divided into small teams, if possible and instructed to work on separate days. Instructions should be given to work in a single area of department and avoid unnecessary movement to other areas and gatherings. Meetings, academic activities, and interdepartmental rounds should be done online. Regular updates should be given to all staff members using E-mail. Daily temperature monitoring should be encouraged.

Any staff member who is feeling unwell should be instructed to work from home, if possible. Any HCW who develops fever, flu, cough, headache, anosmia, muscle ache, or breathlessness should inform the in-charge and the hospital's/area's COVID-19 management team for necessary action. To protect family members, one should change clothes and bath immediately after reaching home.

Patient Scheduling

The general consensus is to postpone all elective medical, surgical, nuclear medicine and other imaging procedures till this crisis subsides. Most departments have reduced patient volume by rescheduling nonurgent and follow-up cases. Research studies have been minimized or stopped at academic institutes. Any radiopharmaceutical imaging should be done if it will have a major impact on further management, especially if patient is an in-patient and suspect or confirmed COVID-19 case. Screening of patients should be done at the time of scheduling.

Screening

Hospital in-patients and suspect or confirmed COVID-19 cases should be assigned into high-risk category. According to the revised Indian Council of Medical Research testing strategy for COVID-19, the following group of patients are suspect cases.

- All symptomatic individuals who have undertaken international travel in the last 14 days
- All symptomatic contacts of laboratory-confirmed cases
- All hospitalized patients with severe acute respiratory illness (fever and cough and/or shortness of breath)
- All symptomatic HCWs
- Asymptomatic direct and high-risk contacts of a confirmed case should be tested once between day 5 and day 14 of coming in his/her contact.

All patients and visitors to the department should be

1 screened at the first point of contact. Front desk team should
2 be trained or reassigned for this work. Notice/pamphlets
3 should be pasted for patient information. Screening can
4 be done using a combination of thermal screening, taking
5 pertinent history at the first point of contact using a
6 questionnaire, self-declaration by the patient or discussion
7 with the referring physician.

8 Patients should be moved to an isolation room and
9 COVID-19 team should be contacted in case of suspicion.

10 **Isolation Room**

11 An isolation room should be designated to hold any
12 suspected case till COVID-19 team takes over. The room
13 should have negative air pressure and label on outside door
14 to warn staff and visitors.

15 **Patient Waiting Area**

16 Patient waiting area should have enough space to
17 accommodate all patients while maintaining a distance of
18 3–6 feet in-between. The number of attendants should be
19 limited to one to prevent overcrowding. The waiting area
20 should have good ventilation.

21 Patients should be made aware of cough and sneeze
22 hygiene using pamphlets/notice, etc.

23 Separate hand washing area and tissue boxes should be
24 available to patients. Masks should be provided to patients
25 with respiratory symptoms.

26 Temporal and spatial segregation may be used to separate
27 high-risk cases from others. High-risk cases/inpatients
28 should be imaged at the end of day, using separate waiting
29 areas or cameras, if available.

30 **History Taking**

31 The doctor taking patient history should follow hand
32 hygiene practices, wear Mask, and maintain a distance
33 of 3–6 feet with the patient/attendants. One should try to
34 avoid any physical contact and reduce the time spent with
35 each patient.

36 **Nursing Staff**

37 Nursing staff comes into close physical contact with the
38 patients to check vitals, cannulation, and de-cannulation.
39 Nursing staff should be provided with proper PPE including
40 triple-layered surgical masks, gown, disposable gloves, and
41 goggles. Nurses should be instructed to discard gloves, wash
42 hand, and use hand sanitizer after physical contact with each
43 patient. Hospital gown should be given to each patient, and
44 masks should be given to patients having cough.

45 **Radiotracer Injection/Administration**

46 Persons injecting/administering radiotracer to a high-risk
47 case should wear PPE (safety goggles or face shield, gown,
48 disposable latex gloves and shoe covers).

49 **Post Injection Waiting Area**

50 Instruct patients to maintain a distance of 3–6 feet and
51 avoid overcrowding. A sign should be put up to close
52 toilet lid before flushing as aerosols are generated during
53 flushing.

54 **Scanning**

55 Patients must be advised to wash hands or use hand
56 sanitizer before and after scanning to avoid contamination
of scanner couch. Disposable sheets should be used on
patient bed and changed after every scan. Technologists
should wear mask and practice frequent hand washing/use
sanitizer.

57 **Disinfection/Decontamination**

58 Parts of scanner that come in contact with a patient should
59 be decontaminated after every scan. Computer, mouse,
60 keyboard and other surfaces should be decontaminated at
61 regular intervals during the day or at the end of the shift.
62 Staff should be trained for decontamination procedures.
63 SOPs for spills should be established. Many disinfectants
64 are effective against SARS-Cov-2. Manufacturer's
65 recommendations should be followed for disinfection of
66 equipment. Electronic parts should be disinfected after
67 turning off the system. Spray or liquid should never be
68 poured on any system part to avoid electronic shock or
69 damage to the system. Deep decontamination of scanner
70 room is needed after imaging a COVID-19 positive case.

71 **Imaging a COVID-19 Positive Patient**

72 It is preferable to postpone the study if it is not going to
73 impact management in a significant way. All staff members
74 should be aware of the patient's COVID-19 status before
75 he/she is shifted, and those coming in close contact with
76 a confirmed case should wear proper PPE. Patients should
wear mask and gown during imaging and procedures.
Patients should be made to stay in an isolation room
with air filters/negative air pressure. Such cases should
be scheduled as last case for the day and made to spend
as less time as possible in the department. Deep cleaning
of the room is performed after each patient (30 min for
decontamination and 1 h for passive air exchange). Other
patients and staff in the practice at the time of the patient
visit should be logged.

77 **Contact Tracing**

78 Take care to note down the name of doctor, nurse,
79 technologist and other staff on file for each patient for
80 contact tracing if need arises later on.

81 **Reporting**

82 Large reporting rooms with multiple workstations should be
83 restructured in the current scenario to single-station reading
84 rooms. Tele reporting from home may be done if there is

need for isolation. Home workstations may be deployed. One should screen positron emission tomography (PET)/single photon emission-computed tomography (CT)-CT for suspicious COVID-19 findings such as 18F-fluorodeoxyglucose avid peripheral ground-glass opacities in the lung fields. Asymptomatic patients with such findings should be immediately shifted to the isolation room and COVID-19 team should be informed for further action.

Special Considerations

Ventilation perfusion scan (V/Q scan)

Most centers have stopped ventilation part of scan for the time of outbreak.

Stress myocardial perfusion imaging

Exercise stress leads to increase in respiratory rate and can cause increased aerosols in exhaled air. Efforts should be made to use the fastest stress first 1-day protocol with pharmacological stress.

Radionuclide therapy

Consensus it to postpone nonurgent radionuclide therapies. Few have proposed that thorough screening with/without COVID testing should be done prior to performing any radionuclide therapy because dealing with any patient who may have developed COVID symptoms after radionuclide therapy will be difficult. CT chest may be used to rule out subclinical lung involvement before therapy is planned.

Positron emission tomography-guided interventions

PET-guided biopsies from lung can be associated with a high risk of aerosol exposure.

Summary

Nuclear medicine departments should prepare to continue operations and to reduce the possibility of in-hospital transmission of COVID-19. Hygiene and respiratory infection control practices should be reinforced, and SOP should be established. The principles of “Time, Distance, and Shielding” should be followed to tide through COVID-19 crisis.

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