

# The American College of Nuclear Medicine Guidance on Operating Procedures for a Nuclear Medicine Facility During COVID-19 Pandemic

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**Abstract:** The novel coronavirus 2 pandemic is causing widespread disruption in everyday life necessitating urgent and radical adaptations in operating procedures at nuclear medicine facilities. The potential for causing severe illness, COVID-19, calls for strict observance of preventive measures aimed to mitigate the spread of the virus. The threat of COVID-19 is particularly serious as there is no vaccine and no specific antiviral therapy. Further complications are introduced by shortages of personal protective equipment for healthcare workers who have direct contact with patients and effective testing to identify infected patients, raising the need for delaying some testing and therapies. Certain vulnerable segments of the general population have been identified (advanced age and certain comorbidities), which should heighten further their preventive efforts. Therefore, this guidance is intended to be operationalized depending on a facility's specific needs and local disease prevalence.

**Key Words:** coronavirus, coronavirus identified in 2019, COVID-19, severe acute respiratory syndrome coronavirus 2, SARS-CoV-2, pneumonia, viral, COVID-19-associated pneumonia, single photon emission computed tomography, computed tomography, nuclear medicine, tomography, x-ray computed, clinical practice guideline, infectious disease

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COVID-19 is a propagated outbreak caused by a recently emerged coronavirus<sup>1</sup> SARS-CoV-2.<sup>2</sup> The person-to-person transmission occurs by respiratory droplets, aerosol, and through contact with contaminated surfaces. The virus is especially perilous because of a relatively high virulence and secondary attack rate (27%–44%),<sup>3</sup> as well as a long residence on surfaces and in aerosolized droplets.<sup>4</sup> Therefore, it is of utmost importance to implement the recommended interventions for mitigation of spread by distancing at work and social settings, reduction of patient traffic at a facility, screening of the patients for COVID-19 symptoms, and exposure risk assessment. This document also aims to assist in developing standard operating procedures for managing a patient under investigation (PUI) for COVID-19. During the COVID-19 pandemic,<sup>5</sup> scheduling of examinations should be judicious, equipment disinfection should be practiced before each patient, medical service sustainability should be optimized, all aerosol-generating

tests must be avoided, and time of staff-patient contact should be minimized for each test in order to contain the contagion. Teleconsultations may help reduce exposure where possible. This operating procedure guidance is not a replacement but a narrative and an addition to other guidance and position statements issued by other relevant organizations.<sup>6–12</sup>

## PURPOSE

This document aims to provide specialty-centered guidance for nuclear medicine facilities during COVID-19 epidemic/pandemic. It is not intended to provide guidance for general public, third-party payers, or for governmental regulatory entities.

## GLOSSARY

**2019-nCoV**—This name was provisionally given to the virus discovered in 2019, a novel coronavirus, which first caused an outbreak of the viral illness in Wuhan, China. The name was later abandoned and replaced by the permanent designation (see below).<sup>2</sup>

**Case Fatality Rate (CFR)**—It is the proportion of deaths from the disease compared with the total number of people diagnosed with the disease for a certain period.

**Close Contact**—Defined as being within approximately 6 feet of a COVID-19 patient without personal protective equipment or having unprotected direct contact with the secretions or excretions from a patient with confirmed COVID-19.

**COVID-19**—A disease caused by a coronavirus that was first identified in December of 2019 in Wuhan, China, and caused by SARS-CoV-2 (see the definition below). The typical manifestations are flu-like respiratory symptoms of various severity.

**COVID-19 Associated Pneumonia (C-19AP)**—Pneumonia that results from SARS-CoV-2 infection and represents a more advanced stage of COVID-19 illness.

**Healthcare Personnel (HCP)**—All paid and unpaid persons (excluding clinical laboratory personnel) serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials, including body substances; contaminated medical supplies, devices, and equipment; contaminated environmental surfaces; or contaminated air.

**High-Risk Patients (HRP)**—Patients uncovered during screening as traveled to epicenters of COVID-19 or in close contact with a PUI or a patient confirmed of COVID-19, in the past 14 days.

**Nuclear Medicine Facility (NMF)**—A physical site where nuclear medicine is practiced and typically includes the imaging space(s), reception space(s), patient waiting space(s), a “hot lab,” and so on.

**Nuclear Medicine Physician (NMP)**—A physician licensed to practice nuclear medicine at an NMF.

**Patient Confirmed of SARS-CoV-2 Infection (PCSI)**—Symptomatic or asymptomatic patient with a positive confirmatory laboratory or imaging test for SARS-CoV-2 infection.

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**Patient Under Investigation for COVID-19 (PUI)**—Patient with symptoms of viral influenza-like illness but not tested with laboratory or imaging modalities.

**Personal Protective Equipment (PPE)**—Equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.

**Primary Care Provider (PCP)**—A qualified healthcare provider managing a patient who was referred to an NMF for testing and/or therapy

**Propagated Outbreak**—An outbreak that does not have a common source, but instead spreads person to person.

**SARS-CoV-2**—The name permanently designated to the novel severe acute respiratory syndrome coronavirus of the species SARS-CoVs.<sup>2</sup>

**Secondary Attack Rate**—A measure of the frequency of new cases of a disease among the contacts of known cases.

**Suspicious Incidental Findings (SIF)**—Incidental identification of findings on a localizing CT that includes the chest, which are suspicious for C-19AP.

**Transmission of Infection**—Any mode or mechanism by which an infectious agent is spread through the environment or to another person. There are 2 types of transmission—direct and indirect.

**Virulence**—The proportion of persons with clinical disease, who after contracting the infection become severely ill or die.

## GUIDING PRINCIPLES DURING COVID-19 PANDEMIC

1. Nuclear medicine examinations are necessary for contemporary medical management. They should be scheduled at the earliest possibility but require judicious balancing of risks associated with a test or a treatment postponement versus associated risks of exposure to SARS-CoV-2 by patients and personnel.
2. SARS-CoV-2 is highly virulent and causes a relatively high case fatality rate.<sup>13</sup>
3. Because SARS-CoV-2 can be transmitted by asymptomatic hosts, extensive precautions and strict adherence to contagion mitigating operating procedures are required.
4. Patients with a diagnosis of cancer, especially during their treatment, are more susceptible to COVID-19 and likely to have poorer outcomes than otherwise similar individuals.<sup>14,15</sup>
5. Patients who are older have poorer outcomes once infected with SARS-CoV-2 as compared with younger but otherwise comparable individuals.<sup>15,16</sup>
6. The facts and understandings about SARS-CoV-2, COVID-19, and C-19AP are rapidly evolving, requiring constant vigilance for new knowledge that may necessitate dynamic updates to this document.

## RECOMMENDATIONS

### Facility-Focused

1. It is recommended to have an institution- or a facility-tailored consideration for the following general items.
  - a. Screening approach to identify cases for isolation as a PUI and for processing HRP through systematic evaluation with on-site designated staff members.
  - b. Identifying designated isolation area(s) for isolating PUIs before disposition.

- c. Identifying designated personnel (eg, infectious disease consultant on-call, etc) for reporting a PUI encounter and for deciding on testing feasibility in HRP.
- d. Acquiring, distributing, and maintaining sufficient supplies for deliberate SARS-CoV-2 prevention (eg, hand sanitizers, masks, PPE, etc).
- e. Identifying contacts for reaching environmental health personnel for deep cleaning/disinfection of potentially infected areas and surfaces.
- f. Identifying practicable sanitation procedures and its frequency for the HCP.
- g. Reviewing as soon as possible and before the next patient enters the imaging suite all localizing CT images that include a whole or part of a chest for the presence of SIF that have been seen in about 9% of all PET/CTs during pandemic.<sup>17</sup>
  - i. CT images should be viewed promptly in a lung window.<sup>18</sup>
  - ii. Edge enhancement could improve SIF visualization on a localizing CT.<sup>18</sup>
- h. Identifying a set of SIFs that should trigger the PUI procedure.<sup>18</sup>
- i. Understanding PUI procedure and how to activate it is paramount and should include notification of designated personnel and isolation of a PUI.<sup>18</sup>

- i. If the patient is at NMF, immediately move the PUI to an isolation area.
- ii. If the patient left an NMF, inform PUI by phone to initiate isolation at home and consult the PCP as soon as possible.
- iii. Inform a PCP about the findings and instructions provided to a PUI.

- j. PUI encounter handling personnel varies among NMFs and commonly includes an infectious disease consultant, individual(s) responsible for deep cleaning and disinfection of areas (environmental health personnel), contacts, and equipment.
- k. Knowing who is responsible for completing/submitted state required forms to a Department of Health and ensuring their participation in handling a PUI.<sup>18</sup>
- l. Planning, implementing, and monitoring staff safety training, including the PUI handling, monitoring, restriction implementation, and proper reporting.

1. Develop a site-specific standard operating procedure for minimizing patient volume and direct contact duration with patients by optimizing examinations, postponing elective studies whenever possible, as appropriate for and commensurate with local factors.
2. Establishing service continuity plan with the aim of reducing the risk of NMP staffing falling below operational and going out of service due to SARS-CoV-2 infection.

- a. Separating NMPs at an NMF into at least two or, preferably, 3 units/teams, working separately, 1 week at a time, to avoid staff cross-contamination with SARS-CoV-2.
- b. If a unit consists of more than 1 NMP, one should have a physical presence on site to supervise radiopharmaceutical administrations and respond to medical emergencies, while another/other member(s) should be interpreting examinations from home, using a Tele-Nuclear-Medicine station, or from an isolated room(s) on site.

4. Avoid use of ventilation scintigraphy, especially based on aerosolized liquids, since they may hasten transmission of SARS-CoV-2.<sup>17</sup>

- a. Consider perfusion scintigraphy in combination with chest x-ray<sup>4</sup> or SPECT/CT protocol<sup>19</sup> using corresponding interpretation criteria.
5. Minimizing contact time with patients with known or suspected COVID-19 or a potential for droplet contamination.
  - a. Shortening imaging time whenever possible, such as selecting appropriate patients for stress-only myocardial perfusion scintigraphy.<sup>19</sup>
  - b. Arranging all patient-care meetings and consultations as virtual whenever possible.
  - c. Rescheduling elective scans for a later date.
  - d. Using flat keyboards for optimal disinfection after individual use.
  - e. When a nuclear medicine test is the most optimal of available options for answering a clinical question, cannot be substituted by a test with shorter duration of staff-patient contact, and time-sensitive, if it is, scheduling it as the last case of the day for all known PUIs or PCSIs.
6. Minimize in-person meetings with colleagues, communicating by phone, e-mail, or videoconference whenever possible.

### Patient-Focused

1. Place reminder notice throughout NMF to improve adherence to social distancing and wearing of personal masks, including waiting rooms and the registration areas.
2. Consultations with patients, such as for those to prepare for radiopharmaceutical therapy, should be performed using Health Insurance Portability and Accountability Act-compliant telemedicine methods.
3. Provide to the patient and/or guardian as much information as possible by phone in advance of arrival to an NMF, including screening questions for COVID-19 risk and explanation of the test or therapy to be performed, in order to minimize the time spent in close in-person contact.

### Healthcare Personnel-Focused

1. Maximize protection for HCP
  - a. For engaging with a PUI and PCSI, it is recommended to wear the full PPE.
  - b. For the staff injecting patients with confirmed or suspected COVID-19, a face shield, isolation gown, disposable gloves, and shoe covers are recommended.
  - c. For engaging with patients unlikely to be infected, protective measures should be based on local circumstance and the prevalence of COVID-19.
  - d. Avoid close contact, except when unavoidable (eg, cannulation).<sup>20</sup>
  - e. In assigning HCPs to specific roles at an NMF, a risk-adapted approach is recommended with consideration given to the significantly higher case-fatality rates from COVID-19 among older people<sup>13</sup> and those with chronic diseases.<sup>21</sup>
  - f. Because of rapidly evolving COVID-19 evidence, vigilant monitoring of emerging knowledge is necessary, including those provided on the ACNM Web site.

### CT FINDINGS

1. Chest CT findings are not diagnostic of COVID-19 or C-19AP. It is not recommended as a screening examination

though the findings can be suggestive in the appropriate clinical context.<sup>22</sup>

2. The earliest findings are ground-glass opacities (GGOs), which are usually bilateral, but can be unilateral in rare cases, involving a right lung more often than the left.
3. Chest CT findings are variable and can be negative, particularly in early stages of C-19AP.
4. The patterns of chest CT findings in C-19AP evolve overtime and these have been well described with expert consensus guidance provided.<sup>22</sup>
5. Chest CT findings of C-19AP can appear similar to findings seen in atypical pneumonias, especially other viral pneumonias. One study has described the diagnostic performance of CT in discriminating C-19AP from other viral pneumonias.
  - a. Some findings are more common in C-19AP as compared with other viral pneumonias, including a peripheral distribution (80% vs 57%,  $P < 0.001$ ), ground-glass opacity (91% vs 68%,  $P < 0.001$ ), and vascular thickening (58% vs 22%,  $P < 0.001$ ).<sup>22</sup>
  - b. Calling C-19AP by US-trained radiologists out of a mixture of chest CT cases with atypical pneumonias had a sensitivity of 73% to 93% and specificity of 93% to 100%.<sup>23</sup>
6. Incidental CT opacities of C-19AP may be FDG-avid and/or non-FDG-avid, depending on their duration and inflammatory activity.<sup>24-32</sup>

### CONCLUSIONS

The recommendations provided in this position statement are based on the current best practices narrated from current literature, as well as publications from the World Health Organization and the Centers for Disease Control and Prevention. They are geared to practices common within the membership of the American College of Nuclear Medicine. The knowledge about this novel virus is evolving rapidly and even the essential principles may occasionally change. Therefore, frequent updates may be needed to this and other related guidelines. Although the outlined principles are universal, their practical applications and implementation are dependent on prevalence dynamics of COVID-19 at specific locations and resources available to individual NMFs.

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