

# Nuclear medicine practices in Pakistan in the times of COVID-19: steps to move forward

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## ABSTRACT

Corona Virus Disease-2019 or COVID-19 is a highly contagious disease caused by a variant of the Coronavirus family. This disease has surfaced from Wuhan, China in December 2019 and has spread to more than two hundred countries and territories in World infecting millions of people around the globe. Pakistan is among top 30 countries, which are severely hit by this pandemic. The numbers of infected cases are increasing at rapid pace. To counteract the rapid spread of this contagion, Government of Pakistan has imposed a partial lockdown in the country since 23rd March 2020. Healthcare services are one of the essential services, which are working at its plausible capacity even under these restrictions. Nuclear medicine being a part of healthcare services has to rapidly embrace the shifting paradigms of patient care. New guidelines and standard operating procedures need to be developed to continue essential nuclear medicine services to prevent spread of this highly transmittable infection among staff and patients. These recommendations and guidelines should be safe, reasonably practical, and in line with the international, national, and hospital policies to combat COVID-19. This article offers a few suggestions and recommendations for efficient and safe delivery of nuclear medicine services.

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## Introduction

Coronavirus was discovered in 1960 by a group of virologists lead by Tyrrell et al. [1]. Corona viruses comprise of a diverse family of enveloped RNA viruses [2]. It has the potential to infect a broad range of hosts and causes serious health problems related to respiratory, gastrointestinal, and nervous systems in animals and humans. Since the identification of Coronavirus, almost seven decades back, many subtypes of this virus have been identified. The initial association of coronavirus with the human respiratory tract pathology was reported in late 1960s [3].

In December 2019, China reported a series of cases with respiratory symptoms and atypical pneumonias in Wuhan. Upon further investigation, the causative organism was found to be a variant of Coronavirus family [4]. This virus was named as SARS-CoV2 by International Committee on Taxonomy of Viruses [5]. World Health Organization (WHO) on 11th February 2020 named the disease caused by this virus as Corona Virus disease-2019 with an acronym of COVID-19 [6]. It causes acute febrile illness with respiratory distress syndrome. WHO has declared it as pandemic. So far this, pandemic has spread in more than 200 countries and territories of the world and has infected 2,314,621 people and resulted in 157,847 deaths according to the daily situation report issued by WHO on 20th April 2020 [7].

COVID-19 is a highly contagious disease and spread is postulated to be through respiratory droplets or fomites.

The published data showed that this virus has an incubation period of 0–14 days (mean of 5.1 days) with symptoms usually appearing between days 5 and 10. An alarming aspect about this infection is that the patient is shedding viruses in initial asymptomatic phase and is highly infective [8].

Throughout the world, healthcare workers are exposed to this highly contagious pandemic. Steps like personal hygiene and social distancing of one meter have been recommended to reduce the spread of this contagion. To counteract the extensive spread of this infection, almost all the countries and regions of the world have imposed partial or full lockdowns. However, these lockdown policies are not imposed on many of the essential services like healthcare facilities. Healthcare workers have an increased risk of exposure since they are; most exposed to confirmed cases, need to be in proximity to treat, and perform procedures that might be associated with aerosolization from the patient.

Nuclear medicine, being a part of the imaging services of many healthcare facilities, is also facing a number of challenges due to prevailing uncertainties. Although these challenges are similar to general radiology, yet they are different in many ways. These differences are related to relative non-urgency of the nuclear medicine scanning, nonavailability of portable equipment, injected patient's

exposure to the staff, long imaging duration, and involvement of injectable radiopharmaceuticals (RPs).

The area of concern for any healthcare service that is not actively engaged with the management of COVID-19 patients is the uncertainty of coming into contact with an asymptomatic COVID-19 carrier, which can potentially expose the healthcare staff and cause disease spread. So the first and foremost step in nuclear medicine should be an exhaustive and detailed screening of the patients comprising of: recent travel history, contact with COVID-19 patient, occupational exposure history, typical COVID-19 symptoms, etc. There is a spectrum of reported COVID-19 symptoms in the literature, but fever and dry cough are most commonly reported symptoms [9]. Hence, the most important symptom to ask for in history is fever and cough. Another important point in screening the patient for COVID-19 is exposure or contact. The suggested algorithm for patient screening and handling in a nuclear medicine department is given in Figure 1.

In addition to scrutinizing the patient at point of entry, there are a number of steps, which should be implemented to prepare a nuclear medicine facility for uneventful and safe operations during the contagion spread. These special needs areas address the changes in the department's infrastructure, preparation of staff, patient selection criteria, equipment safety procedures, protocol modifications, etc.

Few areas of special consideration for nuclear medicine are:

### *Department readiness*

For continuing essential nuclear medicine services, the department should have laid down guidelines or standard operating procedures (SOPs), which should be in line with all international/national/hospital SOPs, or guidelines for dealing with COVID-19 patients. These SOPs and guidelines should cover all the basic infection control and basic hygiene procedures recommended by National Institute of Health, Pakistan and/or WHO [10,11]. There should be clear recommendations for all the possible situations which can arise in the department. Departmental staff should have basic training about infection control and hygiene with special focus on handling patients and machines. Posters emphasizing the need of social distancing, hand washing, and respiratory hygiene should be displayed at prominent locations in the patient waiting areas. There should be a clear demarcation of the patient designated areas with highlighted pathways and demarcation for appropriate distancing. Hand washing and sanitization facilities should be accessible to the patients in waiting areas. There should be a team or a focal person responsible for COVID-19-related activities in the department, who should coordinate between the hospital administration and department for smooth operation and replenishment of essential items, such as PPE, disposable sheets, surgical masks, disposable vinyl or latex gloves, machine cleaning liquids and solutions.

The waiting and injected patient areas should have seating arrangements to maintain safe distancing. Door knobs, door handles, switches, table tops, telephone sets, keyboards, hard surfaces of clinics, and examination rooms, etc should be daily cleaned in the morning before the start of the work and after finishing the daily work. Sanitization spray in the department should be done as per institution policy. There should be a separate area designated for suspected or confirm COVID-19 patients where they will stay before injection, during uptake time, etc. These suspected or confirmed COVID-19 patients should have minimum footprint within the department and should be released immediately after the procedure is complete. There should be no mixing of COVID-19 and non-COVID-19 patients at any times.

### *Patient selection*

The department should give priority to all those scanning procedures, which are vital for patient management and delaying them can cause significant morbidity. The general trend all over the globe is to perform oncology related scanning procedures, such as <sup>18</sup>F-Fluorodeoxyglucose (FDG), Ga-68-prostate-specific membrane antigen (PSMA)/1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA) scans, Methylene diphosphonate (MDP) bone scanning, pre-chemotherapy glomerular filtration rate (GFR) assessment, radionuclide ventriculography/multigated acquisition (MUGA) etc. However, the preference should be given to those oncology patients whose management is imperative and dependant on nuclear medicine scan findings.

Similarly, in cardiology, all those scan which are required for urgent decision-making should be prioritized. Additionally, any other scanning procedure, which is crucial for clinical decision-making, should be prioritized. All emergency scanning procedures, such as V/Q scan and GI bleed scans should be prioritized accordingly. Special emphasis should be given to the patients referred for V/Q scanning. Detailed history should be obtained and scanning should be limited to perfusion imaging, preferably with SPECT-CT and correlation with the recent X-Ray findings. All other scanning referrals and requests should be individually assessed. Any research related to scanning activities should be rescheduled or deferred for later.

### *Staff readiness*

Staff should preferably be divided into three groups with 1 week on and 2 weeks off roster to avail the quarantine time. If it is logistically difficult, then two groups can be made with 1 week on and off roster. In department where there is difficulty even in splitting in two groups, the staff should be divided into two categories where one half should be in direct contact with patient, e.g., history and examination, injecting RPs and scanning and other half should remotely do the work like processing reporting etc. This way, we can save some staff, which can be utilized in case of exposure to other half.

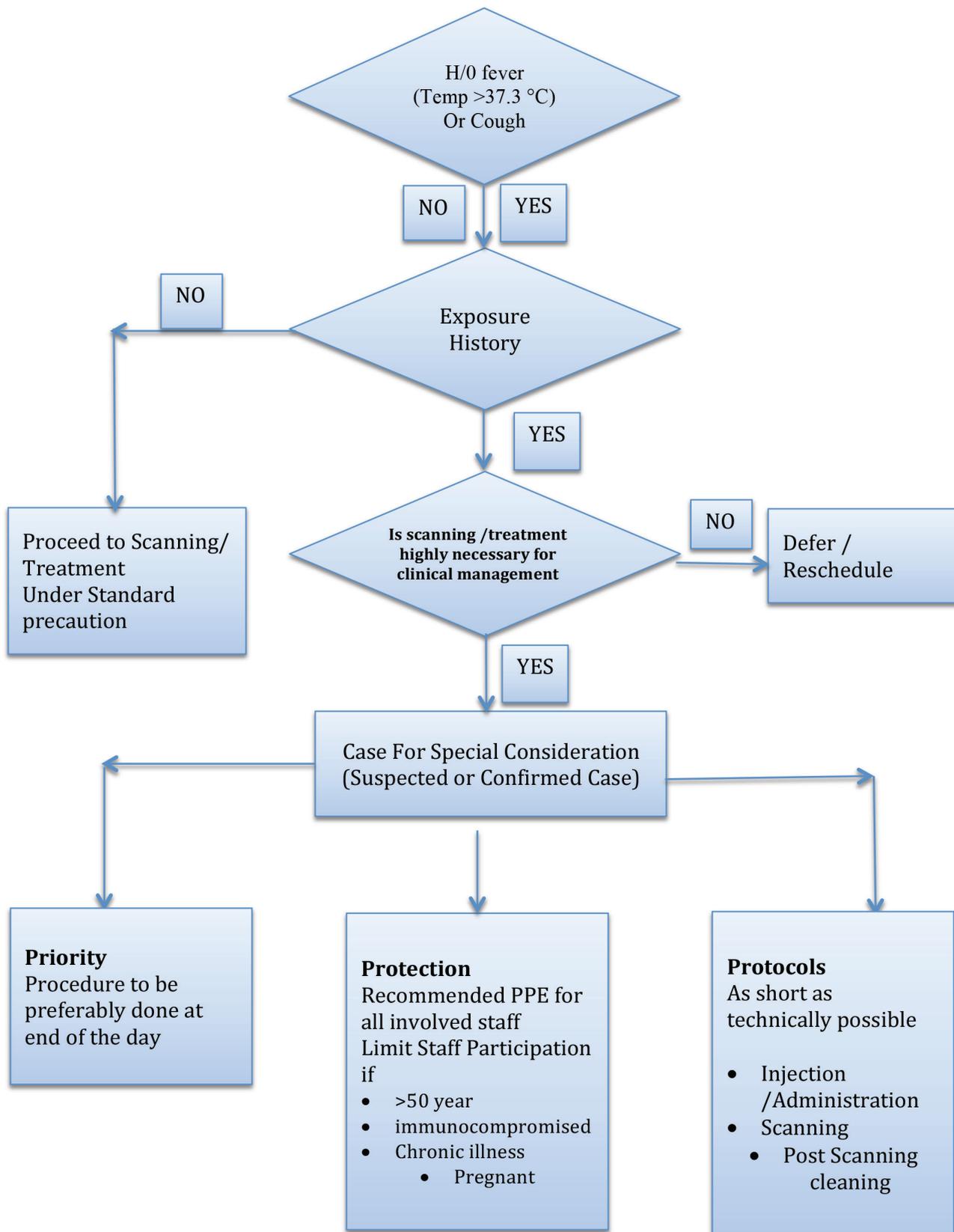


Figure 1. Nuclear medicine patient screening algorithm.

Personal protective equipment (PPE) should be in line with local or WHO guidelines. All staffs who are in direct contact with the suspected or confirmed COVID-19 patients should wear recommended PPE (FFP2 masks, double gloves, disposable gowns, shoe covers, head caps, goggles, or face protective shields) and dispose it off in designated areas after finishing the procedure. All other staffs should wear facemasks and gloves all the time. Staff having the following conditions should preferably avoid direct contact with suspected or confirmed patient: age above 50 years, immunocompromised, chronic illnesses, and pregnant females.

### ***Equipment-related SOPs***

Injection areas and cameras should have extensive cleaning procedures after finishing the daily work. Disposable sheets should be changed after every patient. If there is no suspected or confirmed patient, the cleaning of patient bed, camera gantry, remote controls, keyboards, and mouse should be performed every 3 hours with disinfectant liquid (1,000 ppm chlorine). Cleaning should be done every time after imaging of suspected or confirmed COVID-19 patient. These patients scan should preferably be scheduled at the end of the list. All the cleaning materials and waste sheets, gowns should be disposed off in the designated infectious disease waste bins.

### ***Scanning procedures***

Patient should be scheduled with strict time slots to minimize overlapping and overcrowding in the waiting areas and department. Only one attendant should be allowed to accompany patients. There should preferably be no attendants or accompanying persons in the scanning and post-injection waiting areas. Whenever patient enters the department, a mandatory temperature checking has to be implied. Additionally, patient and their attendants should be required to wear facemasks throughout their stay in the department. Radiopharmaceutical injection should be given after necessary precautions, such as masks and gloves. If a patient is suspected or COVID-19 positive, injection should be given after donning full PPE, which needs to be discarded properly after injecting. Scanning protocol in routine patients should be standard. However, in COVID-19 positive or suspected patients scanning protocol can be tailored to ensure minimal handling of patient by the staff and shortened scanning duration with clinically acceptable imaging parameters. An important aspect is to report if any suspicious and typical COVID-19 CT findings are noted during SPECT-CT or PET-CT examination in an asymptomatic patient. These patients should be directly referred for COVID-19 clinics for further management.

### ***Radionuclide Therapies (RNTs)***

Individual assessment should be done for all the patients prior to undertaking radionuclide therapy. All the radionuclide therapies for benign conditions should preferably be

rescheduled or deferred. Risk versus benefit ratio for every RNTs should be assessed for each patient. All cancer RNTs should be critically assessed and should only be administered if there are no associated risks to the patients, e.g., immunocompromised state, etc. If the patient undergoing RNT is COVID-19 positive or suspected to have COVID-19, patient should be sent for infectious disease consultation and/or treatment first. RNTs can be reconsidered once the patient stabilizes.

All medical physicists, nurses, and ward attendants attending the RNT admitted patients should take protective measures as well and wear mask and gloves while doing daily work in isolation rooms. If the patient is COVID-19 suspected, then full PPE should be worn by attending staff nurses, doctors, and other staff visiting the isolation rooms.

### ***Contingency plans***

Contingency plans and SOPs should also be made if any of the staff member;

- Develops COVID-19 symptoms
- Exposed to an asymptomatic patients who later on tests positive for COVID-19

The staff needs to be isolated immediately and all the contacts need to be tested and quarantined. There should be backup plans if a staff member /group become exposed to the COVID-19.

### ***Availability of the radioisotopes and RPs***

About 85%–90% of the nuclear medicine departments in the country are using locally produced Technetium generator and I-131. Out of 35 nuclear medicine departments, 32 are using locally produced Technetium generator. The local production of this generator is totally indigenous and not dependant on any imported raw material. There is a temporary disruption in supply of these generators due to partial lock-down in country and logistical issue in delivery of these products by the supplier. Similarly, due to ban on air travel, the export from outside country is logistically very difficult. This issue has resulted in a significant drop in conventional nuclear medicine procedures in the country. Additionally, it has become extremely difficult for patients to reach nuclear medicine centres because of nonavailability of the public transport. However, with easing of lockdowns and travel restrictions, it will be possible to get generators and RPs on regular basis in future.

Since there is decrease of radioisotopes/RPs demand world over, the production is suffering a great deal and the manufacturers are reducing their production or shutting down their production plants. In near future, it is predicated that there may be a great deal of shortage of generators, radioisotopes, and RPs, which may result in sharp decline in nuclear medicine activities globally. For this purpose, local production facility in Pakistan need to immediately restart and secure its production capabilities

to avoid speculated slump in nuclear medicine activities. Meanwhile, all centres with onsite cyclotron should acquire the Na-<sup>18</sup>F production capabilities so they can offer Na-<sup>18</sup>F bone imaging in case of shortage of Technetium generator. Many RNTs, such as Lu-177-based peptide receptor radionuclide therapy (PRRT), prostate-specific membrane antigen (PSMA), and I-131 Meta-iodo-benzyl-guanidine (MIBG) are halted as well because of difficulty in obtaining the radioisotopes from Western production units and nonavailability of carrier flights. These unwarranted delays in treatment of the oncology patients can result in recurrence and poor outcomes. These are the issues, which need to be addressed at international levels to maintain the supply chain of the essential diagnostic and therapeutic drugs/radioisotopes/RPs for uninterrupted patient management.

### **Additional recommendations**

All activities involving large crowds, e.g., multi-disciplinary meetings (MDMs), ward rounds, grand rounds, reporting sessions, teaching, and training activities should be halted or switched to web-based applications till the emergency situation is over. Additionally, all the scanning or treatment procedures done under research projects should be postponed as well.

### **The way forward**

Pakistan is still in the evolving phase of disease. There is gradual increase in number of COVID-19 patients and infection related deaths. It is predicted through various mathematical models that Pakistan will hit its peak in month of May [12,13] and after that we will see the decline in number of patients. Despite the prevailing uncertainties, we need to move forward and cautiously restart nuclear medicine services for the urgent scanning and treatment procedures for benefit of the patients.

Telemedicine is another tool, which can be of great help in these shifting nuclear medicine paradigms. Telemedicine has shifted the hospital centred patient care to home-based consultation through laptops or mobile phones. The application of this concept can be applied to patient's consultations, scanning appointments, and report delivery. Through telemedicine, scanning appointments can be easily prioritized after detailed history of the patient without having physical contact. This can also be of great help in easing the patient burden on nuclear medicine departments and reduce unwarranted exposure.

Other web-based applications, such as Zoom, Google Classroom, Google Meet, and Webex can be used for MDMs, teaching and training etc. Pakistan Society of Nuclear Medicine (PSNM) can play a vital part in consensus and guidelines development. It can also initiate series of CMEs for nuclear medicine professionals to face challenging issues affecting nuclear medicine practices.

If we follow the course of disease in countries, which were ahead of Pakistan in disease timeline, e.g., Wuhan and Italy where the life has still not returned to the pre-COVID-19 state. People in these areas are resuming the daily activities with a new level of precautions. Shared experience from these epicenters emphasizes on perpetual practicing of all recommended protective and hygienic measures for safe and uneventful continuity of the nuclear medicine services. In Pakistan, we have to brace these new norms and inculcate these cautionary habits in our daily nuclear medicine practices. The sooner we adapt to these distancing and infectious control steps in our daily routines, the quicker we will be able to achieve pre-COVID-19 nuclear medicine activities' level in the country.

This is evident from the data and information available globally that nuclear medicine practices will show a decrease in volume as compared to the pre-pandemic level. We have to collectively devise the mitigation strategies to counteract this potential threat and proactively address the reasons for this decline.

### **Conflict of interests**

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