



## Guidelines of management of $^{131}\text{I}$ therapy patients during the Covid-19 epidemic

Yousif Abdallah<sup>1\*</sup>, Abdulrahman M. Alzandi<sup>2</sup>, Abdullah ALQahtani<sup>3</sup>

<sup>1</sup>Department of Radiological Science and Medical Imaging, Faculty of Applied Medical Science, Majmaah University, Al-Majmaah, 11952, Saudi Arabia

<sup>2</sup>Radiological Sciences Department, Applied Medical Sciences College, Imam Abdulrahman Bin Faisal University, AD DAMMAM, 32257, Saudi Arabia

<sup>3</sup>Radiology and Medical Imaging Department, College of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Alkharj, 11942, Saudi Arabia

\*Correspondence: [y.yousif@mu.edu.sa](mailto:y.yousif@mu.edu.sa) Received: 07-03-2023, Revised: 21-05-2023, Accepted: 30-05-2023 e-Published: 10-06-2023

Individuals diagnosed with thyroid nodules or thyroid carcinoma (TC) are normally not thought to be at a higher risk of getting SARS-CoV-2 than the general population since they have previously been sent for testing and treatment. This is because they have been immunosuppressed previously. Nevertheless, efforts should be made to give medical aid in the most efficient manner possible during a pandemic. Even while there are numerous thyroid nodules and only a small percentage of them are malignant, the overwhelming majority of thyroid tumors are benign. This is despite the presence of several thyroid nodules. During the current SARS-CoV-2 epidemic, it is suggested that both radioiodine therapy and thyroid surgery for the treatment of benign or malignant thyroid nodules be suspended. In order to ensure a timely diagnosis and, if necessary, treatment, patients should be taught all they need to know and be continuously on the lookout for warning signs. Additionally, patients should constantly be aware of any warning indications. Despite the risk of COVID-19 and SARS-CoV-2 infection, diagnostic procedures (such as ultrasonography, scintigraphy, and fine-needle aspiration), surgical procedures, and radioiodine therapy may be performed; however, each case must be evaluated individually to determine whether these procedures are appropriate.

**Keywords:**  $^{131}\text{I}$  therapy, Nuclear Medicine, Radiology, Covid-19

### INTRODUCTION

The initial detection of the novel coronavirus known as COVID-19 was made in Wuhan, China (2). The World Health Organization (WHO) released an official proclamation of a pandemic on March 11, 2020. It is estimated that 4.5 million people will be diagnosed with the disease, and 300,000 will die as a direct result of the disease (1). 87% of those who became ill did so between the ages of 30 and 79, when they should have been at their most productive. There were 14% cases of severe cases and 5% cases of mild cases (4). Therefore, medical professionals throughout the world are obligated to be adaptable and collaborative in order to fulfill their shared objective (5). Any attempt to divert even a small portion of the healthcare budget away from urgent care will have the opposite effect. A number of organizations have sanctioned the practice of getting assistance from any licensed medical practitioner, regardless of the required level of specialization. The treatment's efficacy is immediately diminished as a result. Due to increased border security, several nuclear medical facilities cannot receive radioactive iodine ( $^{131}\text{I}$ ) and other radioisotopes (especially if only

accessible by air). There have been studies conducted on what radiology and nuclear medicine departments can do to lessen the chance of a pandemic (6, 7), but nuclear thyroid scan lacks direction. Due to the prevalence of thyroid nodules, diagnostic screening for thyroid nodules is an integral component of the practice of nuclear medicine at a number of institutions across the world. Ultrasonography of the neck, with or without fine-needle aspiration cytology, is the most effective method for assessing thyroid nodules (FNA). Radioactive iodine or analogues of iodine can be used to take pictures of the thyroid and study how radioiodine is absorbed (8). Due to this, a thyroid scintigraphy with  $^{99\text{m}}\text{Tc}$ -pertechnetate or  $^{123}\text{I}$  is often performed to diagnose thyroid nodules (9). In contrast, patients with differentiated thyroid cancer require both  $^{131}\text{I}$  imaging and uptake investigations (DTC). Sometimes, radioactive tracers such as  $^{99\text{m}}\text{Tc}$ -sestamibi ( $^{99\text{m}}\text{Tc}$ -MIBI) and  $^{18}\text{F}$ -fluorodeoxyglucose ( $^{18}\text{F}$ FDG) help distinguish benign thyroid nodules from malignant ones. [Bibliography required] (Fortunately, the majority of thyroid tumors develop slowly since only around 10% of thyroid nodules are malignant (11). Surgery is the standard

treatment for both thyroid cancer and big, painful goiters that are not cancerous. As part of their postoperative care, patients diagnosed with DTC frequently undergo risk-adjusted <sup>131</sup>I therapy, whole-body scintigraphy, and SPECT/CT imaging. If tumors have spread to other parts of the body, it is likely that more treatments, such as tyrosine kinase inhibitors, external radiation therapy, and interventional radiology techniques, will be needed to treat them. This investigation's findings will hopefully lead to the creation of recommendations for the uniform application of nuclear thyroidology. This would not only make patients with thyroid nodules or cancer less worried about getting COVID-19, but it would also keep them from having to put off or cancel important diagnostic or treatment procedures. The middle of March 2020 might be the beginning point for identifying an increase in the number of people seeking medical care in our country. As a result, it is more necessary than ever to take steps to avoid infections, especially at healthcare facilities where both patients and staff are at danger of contracting the virus. These proposals should be implemented not just in specific hospitals and regions, but also on a nationwide scale. Both the general public and the medical facility's employees have equal responsibilities for maintaining acceptable levels of cleanliness. As a response to the COVID-19 pandemic, which the WHO declared on March 11, 2020, universal hygiene requirements have been published. These rules have been made to stop the spread of disease and the appearance of new cases of illness (2). Due to the increased risk of exposure to ill or potentially infectious patients, medical practitioners are obligated to take additional safety precautions. By detecting lung abnormalities on computed tomography (CT) scans, radiology departments may be able to reduce the risk of epidemics, according to a number of published studies. This contributes to the diagnosis of COVID-19. On the other hand, nuclear medicine clinics have an unusually restricted number of application instructions (1,3,4). Although there are some similarities between nuclear medicine and radiology, these two areas are distinct enough to warrant having separate sets of criteria. The focus put on diagnostic and therapeutic applications, the duration of scans, the portability of imaging equipment, and the amount of time spent with patients are simply a few examples of these differences. Clinics that conduct nuclear medicine have an increasing demand for preventative application guidance, comparable to other sectors of the medical business that employ algorithms to combat the spread of disease. Due to the measures taken against ionizing radiation, nuclear medicine departments are the only type of clinics required to comply daily with WHO criteria for infection prevention (distance, time, and shielding). In addition to radiologists and nurses who practice nuclear medicine, nuclear medicine technicians are also at risk for contracting COVID-19. During the incubation period of COVID-19, the virus can be transmitted by respiratory droplets or close contact with symptomatic or asymptomatic persons. Infections can also

be transmitted indirectly by contacting contaminated surfaces or objects. There are currently no indications that the COVID-19 virus may spread through the air. However, intubation and oxygen supplementation are two examples of medical treatments that produce aerosols. In healthcare institutions, both of these procedures have the potential to spread disease. There are an abundance of them. Previous coronavirus outbreaks, such as SARS and MERS, which are in the same category as COVID-19, may give knowledge and tactics applicable to the present outbreak (1, 3). Because the great majority of imaging operations and radionuclide treatments (RNT) are performed in an outpatient environment and on a volunteer basis, it is considerably easier to find qualified personnel in the nuclear medicine department than in other fields. In the near future, nuclear medicine-trained doctors will be able to provide the due diligence due to the fact that the bulk of future research will be conducted on hospitalized COVID-19-observed patients. However, the absence of portable SPECT or PET/CT scanners is the source of the most worry. Appointments may be booked over the phone, making it easier for nuclear medicine clinics to identify patients who are sick or at risk of infection with the COVID-19 virus, aiding in the prevention of outbreaks. People hospitalized for any asymptomatic sickness are at risk of catching the virus. This guideline, which has specific recommendations, is meant to protect patients and medical staff in nuclear medicine clinics that still do diagnostic and therapeutic procedures. Since the COVID-19 virus has the potential to propagate and produce a pandemic, this was done.

#### **The impact of COVID-19 on patients with thyroid nodules and cancer**

In the majority of individuals, the existence of comorbidities and demographic characteristics is a stronger determinant of whether a person will become infected with SARS-CoV-2 or acquire serious COVID-19 forms than thyroid status. Individuals with thyroid cancer (TC) who have had disease-specific therapy, such as surgery (with or without <sup>131</sup>I administration), are not believed to be at an elevated risk of contracting a virus, including SARS-CoV-2, compared to the general population (12). Only those with deadly lung metastases or stage IV disease are exempt from this rule (with possible radiation-induced lung fibrosis). Through mechanisms such as angiogenesis and alterations to the tumor's microenvironment, studies have demonstrated that viral infection dramatically increases the probability of TC becoming malignant and spreading (4). But because COVID-19 is a new virus, there is no evidence that it causes cancer right now (13).

#### **The impact of COVID-19 on the diagnosis of thyroid nodules**

Thyroid nodules are quite common and, in most situations, absolutely harmless. Even though the use of ultrasonography (US) to detect thyroid nodules has

increased, the incidence of thyroid cancer (TC) has remained stable (14). Even though it is important for treatment to tell the difference between benign and cancerous nodules, most people with thyroid cancer can still expect a good outcome even if they aren't diagnosed for a few months. A fine-needle aspiration biopsy (FNA) may be postponed if a thyroid nodule does not produce any symptoms. When determining whether an urgent FNA or surgery is required, it is crucial to consider the patient's symptoms and the sonographic characteristics of any thyroid nodules that may be present. Using a scoring system such as TIRADS is one way to achieve this objective (15). (16). Only in the most severe cases should symptoms and signs such as abrupt onset, palpable or visible lymphadenopathy of the neck, and maybe vocal cord palsy be present. The current best practices (17) say that FNA, ultrasound, and cross-sectional imaging are all good ways to quickly diagnose and treat these disorders. It is recommended that individuals with a family history of medullary thyroid carcinoma (MTC) receive more extensive screening and treatment (e.g. serum calcitonin, FNA). A number of diagnostic tests, such as thyroid ultrasonography, scintigraphy, and FNA, can now be delayed. If a patient doesn't need an evaluation right away, he or she shouldn't be forced to get one without first being told about the risks.

#### **The COVID-19 approaches designed to reduce the risk of cancer have an effect on the thyroid cancer diagnostic procedure:**

It is now generally known that avoiding direct human contact is one of the most effective measures that can be used to limit the transmission of the COVID-19 virus (18). However, both of these things have caused conventional medical practice to change. Beginning in March of 2020, patients who need primary care will make the switch from in-person sessions to virtual ones. It is believed that more than 80 percent of consultations are conducted in virtual settings, making use of remote-examination technology created by medical institutes (11,12). Everyone else who works alongside (19). Virtual visits are becoming increasingly popular among both experts and patients; nevertheless, a physical examination and an ultrasound are still required in order to obtain a comprehensive image of thyroid nodules and recurring cancer (13,20). Because of concerns over COVID-19, only a limited percentage of thyroid nodule biopsies can be conducted using a tiny needle (2, 21). Due to the fact that less than 10% of thyroid nodules are cancerous, it has been prudent to postpone the majority of thyroid biopsies during the pandemic. Nodules that have particularly concerning sonographic features according to the TIRADS grading system (15) or clinical signs of obstruction are two examples of the exceptions to this rule (16). Although there were almost exactly the same number of consultations in both 2019 and 2020 (2167 and 2179), in 2020, tele-health was employed in 72 percent of consultations, which was an increase from the 4 percent

that was used in 2019. When compared to the same months in 2019, a smaller percentage of thyroid biopsies were conducted in March 2020 (61%), April 2020 (62%), and May 2020 (63%). Although the rate of high-risk thyroid tumors was lower in May (62%), compared to March (93%), and April (100%), this did not deter us from continuing to treat them (22). It may be concluded from the fact that 73% of patients in April 2019 and 73% of patients in April 2020 had the same findings: patients have not postponed required thyroid cancer surgery. Based on our previous work and the current risk level of community transmission, After the patients have been screened, those who do not require an overnight hospital stay are treated with surgery, I-131, and systemic treatment, and then they are followed up on as outpatients.

#### **Patients in nuclear medicine department:**

##### **Patient Registration**

When patients schedule a follow-up consultation, the clinician or assistant physician who referred them to the nuclear medicine clinic should be questioned about COVID-19 and the patients' previous conditions. Patients should be asked for this information. If feasible, the first registration should take place over the phone. Concerning this situation, immediate action is necessary. Visitors to a nation suffering a COVID-19 pandemic should be actively encouraged to report any symptoms of illness they may be experiencing (23). In the case that patients are unable to call the nuclear medicine secretariat to schedule an appointment, it is conceivable that they may be compelled to submit their information via a form. This will aid in the detection of potentially tainted or suspicious conditions. If a patient's temperature is measured upon arrival, it is possible to distinguish between asymptomatic individuals and those who have consented to get care outside the hospital. Large hospitals and clinics that provide outpatient or referral services could incorporate thermal screening as an option. Using thermal scanning and mass screening technology similar to that deployed at airports, it is possible to acquire rapid readings of the skin's surface temperature. Medical professionals must be aware of the symptoms of a COVID-19 infection, which include high fever, a dry cough, excessive fatigue, and shortness of breath. Additionally, they must be informed that being in close proximity to a person who is believed to be afflicted with the disease is one of the most important risk factors for contracting the sickness. If a COVID-19 issue case is being examined, it is essential that interviewers contact the appropriate nuclear medicine personnel (1,2,9,26). This will prevent interviewers from scheduling a phone session with the wrong individuals. As soon as the essential parties have been alerted, the patient must be transferred to the appropriate institution. Before scheduling appointments, arranging procedures requiring nuclear medicine, or exchanging critical documents, people who provide patient counseling should get training on the risk of COVID-19



transmission. It is highly advised that you use protective clothes designed to combat viruses, such as medical work attire and disposable masks, gloves, and helmets. These goods are available at the majority of medical supply outlets. After these patients have been isolated from the general community, they must be evaluated by a certified infectious disease specialist. If healthcare teams have cause to believe that something is in violation of the guidelines, they should also contact the Ministry of Health. The most recent study advises that patients should wear surgical masks while awaiting test results to prevent the transmission of illness and to conform with normal medical practice. Before proceeding with any more diagnostic or therapeutic operations on the patient, it is strongly recommended to await the results of the COVID-19 test. When COVID-19 endemia is proven to be present, everyone in the hospital is required to wear a mask. The patient has no say in whether or not surgery will be performed. A minimum distance of one meter must be maintained between each separate receiving area. By putting up a similar wall in front of the counseling desk, patients and visitors can always be kept at least one meter away from it (28).

#### **Registration Reception Hall Waiting Area**

In close proximity to the waiting areas, there must be hand sanitizer stations and face mask dispensers. The need for cleanliness is stressed, and patients may be instructed on how to do various cleaning tasks. Due to the increased danger of catching Coronavirus within one (1) meter of the entrance, the waiting area must have ample space. It is advised that the frequency with which each clinic sees patients be used as a reference for selecting a suitable buffer zone. For nuclear medicine clinics unable to provide a one-meter space between patients, it is recommended that the admitted patient and/or their companions be kept outside the clinic to provide the required social isolation distance. Alternately, medical institutions may opt to receive patients one at a time to prevent the waiting area from getting congested (17). Alternately, medical institutions may limit new appointments based on the size of the waiting room. Installing equipment with a high-efficiency particulate air filter is the best way to make sure the waiting room and reception area have enough air flow (17).

#### **When the Patient has been Called for Procedure**

The members of the nuclear medicine team who meet patients, such as nuclear medicine technicians and nurses, will have the most direct contact with infected patients. Because physical contact cannot be avoided during the insertion of an intravenous catheter, and it may take some time, it is essential to identify individuals most likely to be infected prior to this phase. Therefore, information on COVID-19 infection must be included in the patients' anamnesis. In the event that a COVID-19 pandemic is declared, all workers are required to wear the proper

protective equipment (PPE). In nuclear medicine-specific facilities, ordinary personal protective equipment (PPE) is sufficient. The category of disposable objects includes items such as disposable latex gloves, thermal apparel, specialist work gear, and surgical masks, among others. For their own health, contact lens wearers should consider transitioning to glasses. When eye protection is worn, the likelihood of catching an infection from dust and pollen, as well as from other people's hands and faces, is drastically decreased (5). Personal protection equipment of level 2 must be used while examining, cleaning, or imaging equipment that has been used on a sick or potentially sick patient (14). These are the basic minimum requirements for personal protective equipment: A respirator mask with a N95 rating or an equivalent, a disposable protective suit, goggles, and a face shield constitute Level 2 protection. Personal Protective Equipment Level 1 does not, in any manner, accommodate these things (3). A person with a beard or mustache will not be fully protected by a N95 mask or respirator. Consequently, the likelihood that a virus may spread is greatly increased. A person is required to shave in order to prevent sickness (6). Providing medical care to the same number of patients during a procedure requiring full PPE may be difficult. Several things, like the number of confirmed or suspected cases of COVID-19 that have been reported, the number of positive cases that have been hospitalized, and the department's success rate in finding infected or suspicious patients who have been admitted for surgery, may affect these approaches (27).

#### **Develop concepts for restricted waiting areas for radioactive patients:**

After radiopharmaceutical injection, the processing time for the majority of diagnostic and therapy techniques in nuclear medicine might range from a few minutes to several hours. In order to prevent the transmission of the novel coronavirus, individuals in separate radioactive patient sections (PET patients) or in common waiting rooms are expected to maintain at least one meter of spacing between themselves (for gamma camera patients). To ensure that waiting facilities for radioactive patients have enough ventilation, specialized equipment with a very efficient particulate air filter is necessary (3),(6). Crowded venues may provide a greater risk of disease transmission than other types of settings due to the increased impact of environmental factors, such as those affecting asymptomatic patients. Due to the spacious size of the radioactive patient room, it is of the utmost importance that occupancy rates are always kept to a minimal. Once radiopharmaceuticals have been administered to a patient, all following procedures must adhere to the same safety standards as those in place for non-radioactive patients and their companions, as specified in the registration section. Everyone must remember to quickly put on their face masks, since this is the first and most critical step.

**When the patient is scanned**

After each new patient, it is necessary to properly clean and disinfect the scanner and the surrounding area. If there is no visible contamination, scanners and clinics should be cleaned using hospital-grade disinfectants or 1/1000 (one million parts per million) chlorine solutions. In the event of contamination, however, hospital-grade disinfectants must be applied (7). All patient fluids, contaminated urine, and contaminated feces must be removed by means of terminal cleaning processes (7). To be good at their jobs, professional cleaners need to have both the right education and the right amount of experience.

**These guidelines that should be followed while utilizing radionuclides for the Radionuclide Treatments (RNT) during epidemics:**

When transitioning between patients, the scanner and surrounding area must be cleaned and sanitized properly. Scanners and clinics should be cleansed with hospital-grade disinfectants or a chlorine solution containing 1,000,000 parts per million if there is no evidence of sickness. In the event that contamination does occur, however, proper disinfectants for use in a healthcare institution must be utilized (7). Protocols for terminal cleaning mandate the removal of all bodily fluids, polluted urine, and excreta from patients. Examples include, but are not limited to Training and practical experience are key elements in the success of professional cleaners. Cancer patients are disproportionately affected by COVID-19 infections; nevertheless, there is presently neither a cure for this virus nor a long-term therapy that is helpful. It is common knowledge that elderly individuals are more susceptible to illness than younger people. Even though there are a few articles (20, 21) on surgical methods for COVID-19 infection or susceptibility in cancer patients, there has been no research on radiotherapy. Depending on the circumstances, these individuals may require assistance during the surgeries. When a patient is sent to RNT, they have to go through a personal evaluation that takes into account their unique clinical situation in light of these criteria.

The indications and symptoms of COVID-19 infection should be put into a questionnaire, and its results should be recorded. An inquiry must be conducted to see if or whether there are any strange or ill individuals residing in the area or neighboring regions. If a patient is thought to have a coronavirus infection, their appointment should be rescheduled and they should be sent to the right place for COVID-19 testing. If the patient is not in a rush to undergo I-131 therapy or a full-body scan, the treatment for hypothyroidism should be postponed and the patient should be given replacement medication for euthyroidism. In extreme cases, recombinant TSH, which is also called rTSH, could be used instead of hypothyroidism therapy. Third, patients who have been granted a new appointment time but whose RNT does not begin with I-131 must comply with the same requirements as everyone else. When time

is of the essence, any RNT, including I-131, should begin with the COVID-19 infection questionnaire. This holds true regardless of the RNT. Additionally, written documentation is required. Anyone with a fever of 37.3 degrees Celsius or higher who has been in an epidemic area or has had direct contact with an infected person is advised to stay at home for 14 days. At the conclusion of this semester, a second evaluation will be conducted. If the COVID-19 test is negative or if the person is still not showing any symptoms after 14 days of isolation, therapy may be considered. Patients who display signs of a COVID-19 infection or who have positive test findings must be transferred to the appropriate treatment units without delay. After patients finish treatment for COVID-19, he/she will need to evaluate his/her progress and set up a new RNT session. Those with hyperthyroidism who are considering I-131 therapy might benefit from a flowchart similar to those used in cancer situations. To get a negative result on the COVID-19 test, it is essential that patients continue taking the anti-thyroid medicine exactly as prescribed. Only cancer patients are exempt from this provision (5,6,12). Patients with a positive COVID-19 test immediately following RNT are obliged to have the dose rate data documented by the Radiation Protection Officer (RPO), and they must also be provided with a description of their treatment plan prior to being discharged from the hospital. These prerequisites must be satisfied prior to a patient's departure from the facility (22,23). If these patients' circumstances deteriorate (to the point where they require a ventilator, intubation, or hemodialysis) or if they die away, national and international recommendations for the most effective radiation safety and infection transmission precautions must be evaluated. With these rules, it will be easier to figure out the best way to stop the spread of illness (22-28).

**The proper procedure for sterilizing nuclear medicine facilities during epidemics:**

Visual aids such as brochures and in-hospital broadcasts can be utilized to present the ward's patients with the necessary information to encourage them to practice appropriate hygiene and breathe correctly. The gantries of Gamma cameras, keyboards, sphygmomanometer cuffs, and any other surfaces (tables, seats, chairs, and beds) that come in contact with potentially contaminated patients must be cleaned routinely and immediately after use. The N.M. group is responsible for ensuring that there is a sufficient quantity of empty disinfectant bottles around the workplace and that these bottles are continuously replenished. If you must be in close proximity to a sick individual who is coughing or sneezing, cleaning is a safer choice. After a high-risk patient has been treated in a department, the personnel responsible for cleaning the area during and outside of normal business hours should get specialized instruction on how to disinfect potentially contaminated surfaces (3,7). It is necessary to employ a cleaning service so that the cleaning may be conducted on their behalf. Always use the appropriate personal protective

equipment. It is vital to witness a demonstration of the proper way to don and doff this equipment, as well as be given the opportunity to practice. All visitors to New Mexico were highly discouraged from touching their faces, particularly the mouth, nose, and eyes. Put on some waterproof gloves, a face mask, goggles, a face shield, and a face shield, along with some disposable gloves and foot protection. In the state of New Mexico, residents and employees are required to wear eyeglasses, not contact lenses (5). Alcohol-containing hand cleaners are used by NM workers prior to wearing gloves and after removing them. Before and after donning their medical masks, the New Mexico team cleans their hands with virucidal alcohol to avoid the transmission of illness. If there is a possibility of visible contamination from respiratory secretions or other bodily fluids, disposable, full-body protective equipment, such as surgical masks and eye protection, must be worn before cleaning. This covers instances in which contamination is a possibility.

### CONCLUSION

In spite of the concerns raised by the current COVID-19 outbreak, it is possible that the impact of COVID-19 infections on patients and employees of nuclear medicine departments can be greatly mitigated if these departments are equipped with the appropriate personal protective equipment and cleaning procedures. In order to better prepare for future epidemics and fill any likely gaps, we can learn from recent outbreaks and data from case groups.

### CONFLICT OF INTEREST

No potential conflict of interest relevant to this article is reported.

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### AUTHOR CONTRIBUTIONS

YA designed and performed the experiments and also wrote the manuscript. YA performed materials collections, and data analysis. YA, AMA and AA revised experiments and reviewed the manuscript. All authors read and approved the final version.

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