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EDITORIAL

Key elements of preparedness for pandemic coronavirus disease 2019 (COVID-19) in nuclear medicine units

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Background

Coronaviruses are enveloped, positive-sense, single-stranded RNA viruses (27–32 kb genome length) belonging to the Nidovirales order, which cause infection in the respiratory and intestinal tract [1]. This family is genetically divided into four genera, namely alpha, beta, gamma, and delta coronavirus. The first two genera infect mammals, while the latter two spread the disease to birds [2]. To date, seven coronaviruses have been identified as human pathogens, including CoV-229E, CoV-NL63, CoV-HKU1, CoV-OC43, SARS, MERS, and 2019 novel coronavirus (2019-nCoV). According to phylogenetic analysis, the novel coronavirus (SARS-CoV-2) is located in the beta coronavirus genus. This new coronavirus causes severe respiratory tract infection and is also highly contagious [3]. The transmission route of the 2019-nCoV is mostly through close contact, respiratory droplets, and persistence of the virus on inanimate surfaces [4]. However, some studies have shown that the fecal–oral route may be a possible pathway of transmission [5, 6]. The attachment of the virus to the receptor expressed by cells is an essential step in the occurrence of persistent infection in the host. Owing to the structural similarities between spike surface glycoproteins of 2019-nCoV and SARS-CoV-2, virus entry is reportedly mediated by angiotensin-converting enzyme 2 (ACE2) receptor [7]. Furthermore, the tissue tropism and pathogenesis of SARS-CoV-2 infection would be determined by the distribution of ACE2 as a receptor. High expression of ACE2 on various tissues such as respiratory tract cells, the urinary system, and the testes can account for the involvement of several organs in SARS-CoV-2 infection [8, 9].

Owing to the lack of adequate treatment and a vaccine, as well as the asymptomatic incubation period of this emerging virus, every procedure that could rapidly and accurately detect infection is important for the management of this disease, including patient isolation and effective public health surveillance [10]. According to the guidelines published by the Chinese government, samples suspected to be SARS-CoV-2 should be confirmed by a real-time reverse transcriptase polymerase chain reaction (RT-PCR) test [11]. Limitations in

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collecting a specimen from patients and the performance of laboratory kits mean that quantitative RT-PCR has a high specificity but a low sensitivity (60–70%) for SARS-CoV-2 detection. The low sensitivity can lead to poor identification of patients and thus increase the chance of contamination in the community [12]. Imaging, including computed tomography (CT), plays a major role in the diagnosis and assessment of the severity and progression of the disease in COVID-19 infection. An accurate and fast diagnosis of COVID-19-infected patients through a CT scan is possible with computer-aided methods such as deep learning [13]. The reported sensitivity of chest CT has been found to be more than that of RT-PCR (98% vs 71%, respectively) [14]. As it cannot be excluded that infected and suspected COVID-19 patients will be referred to nuclear medicine units, among other health services, special prevention and protection measures for healthcare workers and other patients are essential.

Like any similar circumstances, the most logical way to handle a potential risk is to be informed and systematically prepared. In line with this, the readiness of units is of great importance, as this could cause decreased problem. This document aims to present precautionary and safety recommendations at the time of the COVID-19 outbreak for healthcare workers and to provide the most appropriate information about personal protective equipment (PPE) for nuclear medicine units.

Personal protective equipment for healthcare workers

Healthcare workers are at risk of coronavirus infection in the workplace because of human-to-human transmission and the contagious nature of viral infection. Thus, prevention and control strategies to reduce secondary infections among close contacts and healthcare workers are vital. Previously, international organizations such as the WHO and the Centers for Disease Control and Prevention (CDC) produced useful documents about effective strategies for preventing and treating viral infections including MERS-CoV, Ebola, SARS, and avian flu [15–18]. The WHO-based guidelines on the most effective preventive measures for health workers who have been exposed to a confirmed coronavirus patient in a healthcare facility are illustrated in Table 1 [19]. Notably, the risk of contagion for health workers in nuclear medicine units is high because of the referral of non-symptomatic patients and inadequate protection equipment. The medical director and the security officer should have delivered the right infection control training and evidence-based framework for both patients and healthcare workers, based on the accepted prevention and protection guidelines. Health workers should wear PPE appropriate to their profession or specialty. This equipment consists of a mask (surgical and respiratory), gloves, gowns, shoes, head cover, and eye protection. If the PPE is reusable, it has to be correctly cleaned and decontaminated before and after each use. Details of PPE usage are elaborated next.

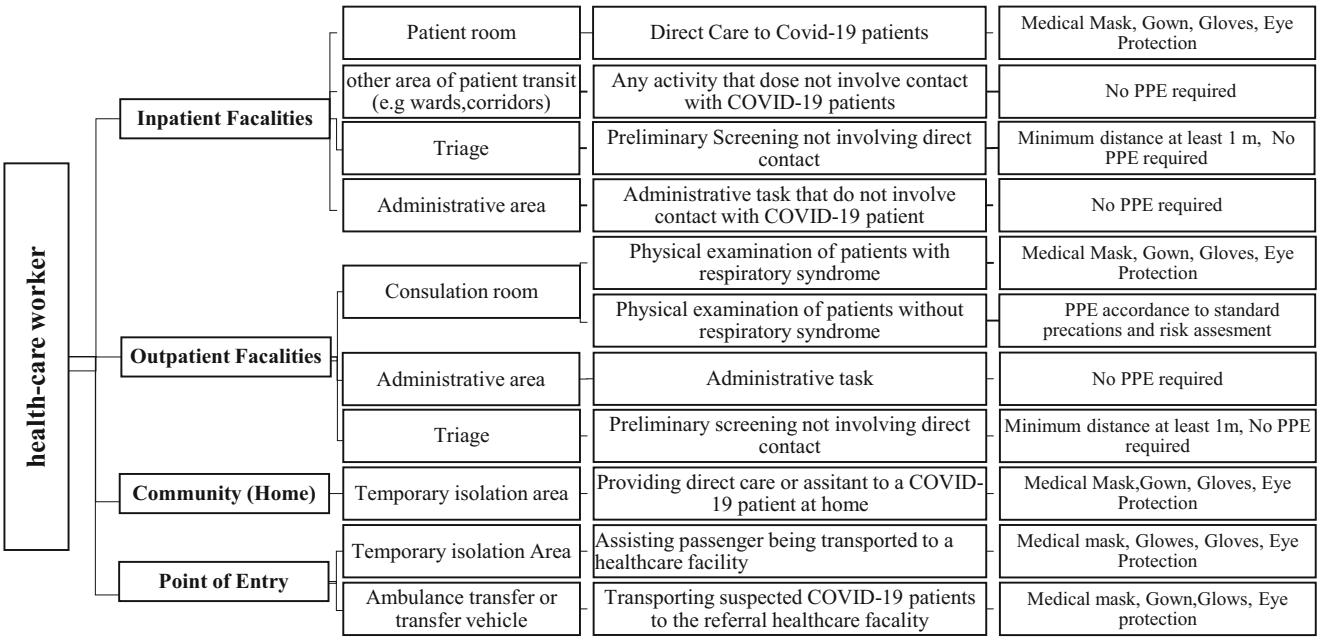
Surgical and respirators masks

There are two main types of masks, “surgical” and “respiratory.” The surgical masks protect against infectious agents transmitted via droplets of saliva or secretions from the upper respiratory tract. Nonetheless, protective or respiratory masks also protect against the inhalation of infectious agents transmitted by airborne paths. Individuals who must wear face masks include every person with respiratory symptoms such as sneezing, coughing, and difficulty breathing, people who are caregivers in their families, and healthcare employees who have been exposed to individuals with confirmed or suspected COVID-19. Surgical masks are disposable, while respirators can be reused by replacing the filter once it becomes full. These two types of masks should not be worn for more than three (for surgical mask) to eight (for respiratory mask) hours at a time, according to the manufacturers’ guidelines.

The respiratory mask prevents the wearer from inhaling aerosols, as well as mist or gases, which are health hazards. It also protects the person from airborne infectious pathogens such as coronavirus, SARS, or H1N1. In the USA, respirators are produced based on the NIOSH (National Institute for Occupational Safety and Health) standard protocols, which divide them into several classes according the degree of oil resistance: classes N, R, and P. On the other hand, European standard EN 149:2001 identifies three classes of disposable particulate respirators: FFP1, FFP2, and FFP3. Various types of respiratory masks are shown in Table 2 (http://emag.medicalexpo.com/which-masks-actually-protect-against-coronavirus/, http://www.safeticorp.com/data/train_img_normal/Respiratory_Protection.pdf, https://www.rogerwjones.co.uk/tsc28938-ffp1-disposable-mask-10) [20].

Therefore, for the contagious patient, a surgical mask must be worn as soon as contagion is suspected. For caregivers caring for a patient with confirmed or suspected coronavirus, SARS, or H1N1, it is imperative to wear a protective mask of at least classes FFP2 or FFP3 (classes N, R, or P in the USA) for the greatest filtration of particles and aerosols. N95 masks are the most favored mask for health workers in a COVID-19 infected situation (http://guide.medicalexpo.com/choosing-a-surgical-mask-or-respirator/) [21]. These masks should be replaced when changing the bowl-shaped mold and the soiled filter. Before touching the mask, hands should be washed with soap and water for at least 20 s, then dried with a clean paper towel.

Table 1 Recommended personal protective equipment (PPE) for dealing with patients with COVID-19 disease, according to the setting, personnel, and type of activity (WHO recommendations)



Gloves

Gloves are made of different materials and differ according to the type of work undertaken. Patients, caregivers, and healthcare workers must use gloves to protect themselves from infections during examinations. Details of the most appropriate professional gloves for healthcare workers are summarized in Table 3 (https://avacaremedical.com/medical-gloves-guide, https://mercatormedical.eu/products/gloves) [22], along with their properties. The first stage in determining which type of gloves would be suitable is identifying the dangers and the corresponding hand protection measures. The best gloves for healthcare workers are, first, latex and, second, nitrile [20].

Wearing a face mask and gloves cannot definitely block infections in any of these circumstances and should be combined with other PPE and regimes, such as hand hygiene, maintaining a distance from people with symptoms, and respiratory hygiene (or cough etiquette). The correct order for donning and removing PPE is also important. The relevant steps are shown in Figs. 1 and 2 (https://www.cdc.gov/HAI/pdfs/ppe/ppeposter1322.pdf). Perform hand hygiene immediately after removing all PPE.

Table 2 Different types of respirator mask to be used for personal protective equipment

Respirator types	Property
FFP1	Suitable for particles larger than 5 μm, 80% aerosol filtration maximum, and 22% leakage to the inside, mainly used as a dust mask (home renovations and various types of work)
FFP2	Suitable for particles between 2 and 5 μm with a minimum 94% filtration and maximum 8% leakage to the inside, mainly used in construction, agriculture, and healthcare professionals against influenza viruses. They are currently used for protection against the coronavirus
FFP3	The most filtering mask of the FFPs, suitable for particles smaller than 2 μm with a minimum 99% filtration and maximum 2% leakage to the inside, using against very fine particles such as asbestos
N class	No oil resistance. A distinction is made between N95, N99, and N100 suitable for particles larger than 0.3 μm, and the number after the letter indicates the percentage of filtration of suspended particles
R class	Resistant to oil for up to 8 hours. Similar to the N class, a division is made between R95, R99, and R100, suitable for particles larger than 0.3 μm
P class	Class P: a completely oil-resistant mask. There are also P95, P99, and P100

FFP, filtering facepiece

Table 3 The most applicable medical gloves

Glove Type	Advantages	Protection Level	
Latex	suitable for biological hazards and water-based liquids. Time usage: 16 h	Bacteria, Viruses (<1% viral penetration rate)	
Nitrile	good versatile, general-use gloves, puncture resistant, greater protection, chemical resistant Time usage: 8 h	chemical materials such as Solvents, Petroleum oils, Gasoline, Greases, Some acids and bases/ viruses	
Vinyl	cost-effective, latex-free, soft, standard protection, less durable well suited for the majority of clinical work	chemical material such as acid and alkali material /viruses	
Nylon	relative protection, cost-effective, no allergic	No viral protection	

General recommendations for nuclear medicine units

The two principal measures to prevent transmission of infectious diseases, namely elimination or removing the risk physically and substitution of the risk, are not applicable to the healthcare setting. Nevertheless, contagion can be reduced by decreasing exposure to transmissible respiratory particles in these units. Therefore, strategies including environmental hygiene, administrative regulations, high work performance, and the correct use of PPE are essential to prevent the spread of infections in a healthcare setting. It has shown that the factors that increase the risk of death in COVID-19 patients include cardiovascular disease (10.5%), diabetes (7.3%), chronic respiratory disease (6.3%), high blood pressure (6%), cancer (5.6%), and certain other underlying diseases (0.9%) [23]. It is recommended that health workers with these risk factors should stop work immediately and take time off away from the unit. Moreover, personnel must be aware of the latest COVID-19 information and recommendations and should check themselves for any signs of disease (subjective fever, cough, or difficulty breathing) before presenting to the

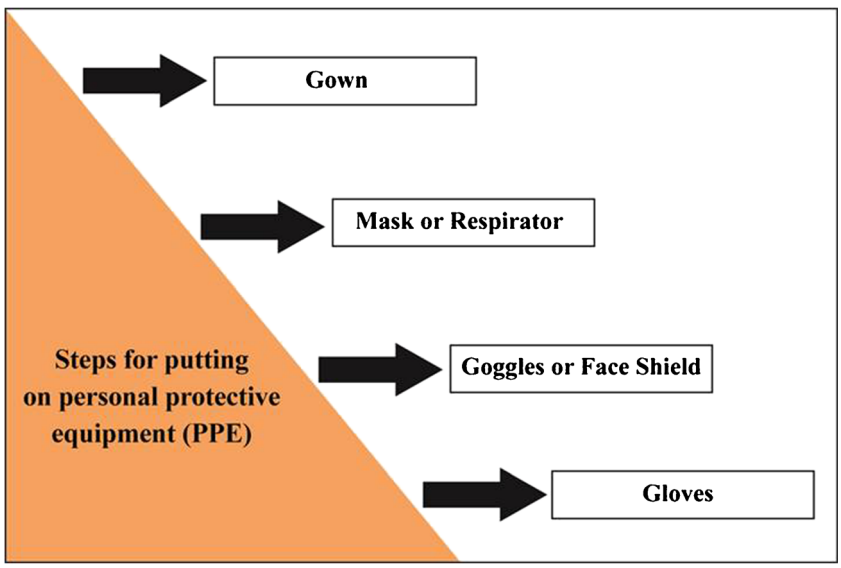


Fig. 1 Steps for putting on PPE

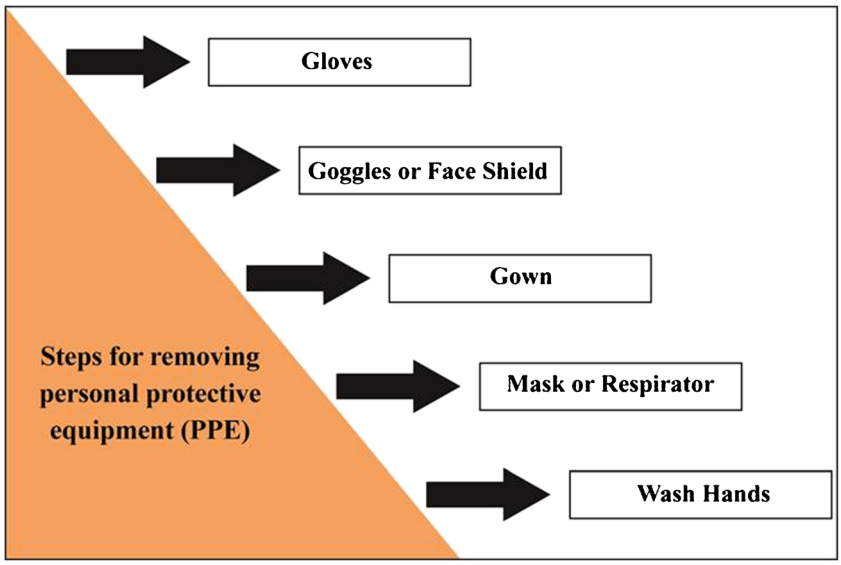


Fig. 2 Steps for removing PPE

facility, as well as informing their supervisor about their condition. They must be monitored for fever and respiratory syndrome twice daily. The most important precautions relating to workers carrying out imaging in nuclear medicine units are discussed next (http://www.cidrap.umn.edu/covid-19/information-employers/healthcare, https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirator-use-faq.html) [21, 23–26].

Planning and coordination of imaging and admission of patients

- As far as possible, do not perform nuclear medicine imaging for patients with fever and respiratory symptoms. Take a history from all patients (fever, cough, or difficulty breathing) and monitor these symptoms in admission processing. Check temperature regularly; if there is fever, imaging must be delayed and rescheduled while additional tests are conducted to determine the probability of COVID-19 infection. Nuclear medicine treatment of suspected or verified COVID-19 patients should be delayed as much as possible.
- Postpone non-urgent thyroid ultrasound examination. If it must be performed, use separate portable thyroid ultrasound equipment in a care unit in which COVID-19-infected patients are isolated. This device should not be used for other non-infected patients.
- Therapeutic procedures with radiopharmaceuticals (i.e., differentiated thyroid cancer, neuroendocrine tumors, metastatic prostate cancer, metastatic castration resistance prostate cancer, radiation) and with radioactive medical devices (i.e., SIRT) should be postponed, according to the clinical need.
- If it can be avoided, do not perform a ventilation scan.
- In order to minimize exposure among patients and health workers, all scintigraphy orders should be performed after careful examination by the clinician and when the results of other pathological and clinical tests are available.
- Consider every strategy that results in minimizing face-to-face contact. For example, the entire processing of admissions must be done carefully before patients arrive in the imaging units (phone-based communication or not in-person referral).
- Try to make regular appointments for imaging and carry out the procedure only at the allocated time. If the timetable has changed, it can be suggested that patients wait at home or in their car.
- As much as possible, portable imaging in emergency wards should be performed in a room with appropriate ventilation.
- For cases admitted to hospitals, before referring the patient to the nuclear medicine unit, the relevant ward should coordinate with the imaging unit regarding probable infection.

Management of patients and environmental hygiene
Managing patients

- Maintain a spatial distance of at least 1 m between non-infected, potential, and verified infected COVID-19 patients and also between patients and health workers to decrease the transmission of pathogens.
- Consider the use of patient cohorting, such as scheduling potential infected and confirmed infected patients at the same time for examination or imaging and non-infected patients at a different time, to reduce the transmission of COVID-19 pathogens to healthcare workers and other non-infected patients.

- Patients in treatment rooms, whether non-infected, potential infected, or confirmed infected, must not be allowed to visit one another or walk in a hallway of the treatment unit.
- After performing imaging, patients and their companions should be asked to leave the units quickly to prevent crowding and more transmission of infection.
- Attendants of patients should not enter the imaging room, except in the case of children and disabled or vulnerable adults, who may be accompanied by at most one person.

Environmental hygiene

- Provide visuals or infographics (posters or signs) advertising the correct use of PPE, including disposable outerwear, gloves, and a surgical mask. Patients must be trained to cover their mouth and nose when coughing or sneezing with a tissue, medical mask, a sleeve, or a bent elbow, to decrease the dispersion of respiratory droplets containing potentially infectious pathogen particles.
- Clearly instruct patients in the "hot" waiting rooms not to sit closer than 1 m to each other.
- Asepsis and cleaning of the wards must be done regularly, with special attention to toilets, doorknobs, reception desks, keyboards, computer mice, and imaging equipment, where hand contact is more likely.
- Wards should be cleaned with solutions containing chlorine or hydrogen peroxide. If possible, use ultraviolet (UV) germicidal irradiation for sterilizing of the systems at least once a day.
- Hand cleaning using an alcohol-based hand sanitizer (60–95% alcohol) should be accomplished before and after putting on or removing PPE.
- All waste receptacles must have a hinged lid.
- After performing imaging of infected or suspected COVID-19 patients, all touched surfaces must be disinfected frequently.
- The bed covering must be changed after each scan. Place waste receptacles in the hallway and waiting room for patients and personnel to dispose of PPE easily if required.
- After performing the scan, the device should be disinfected according to the manufacturer's instructions.
- Disposable paper cups should be laid out separately, not stacked, in a defined place, so that single cups may be removed without touching the others.
- Stick signs to the door or outer wall of the units near the entrance to the healthcare section to warn workers that PPE must be used.
- Make sure that any sink is equipped with soap and disposable paper towels.
- Put alcohol-based hand sanitizers in the hallway, examination, and waiting rooms.
- The hand control of the device should be covered (using a special probe cover, gloves, or cellophane), and its surface should be wiped with an alcoholic antiseptic.
- It should be installed appropriate air-handling systems in the facilities and ensure good airflow within units, as this can dramatically reduce the risk of nosocomial transmission of some coronavirus strains.

Personal protective equipment

- All staff (technicians, nurses, service personnel, and other health workers) should be trained in the correct use of PPE, including the proper sequences for putting on and removing PPE and decontamination of infected equipment.
- All staff in the nuclear medicine unit (physicians, nurses, technicians, receptionists, service personnel) should have appropriate protection equipment (mask, gown, and gloves), and the hospital management, head of the unit, or technical officer is required to equip staff with full-zipped clothing (standard protection), goggles, at least N95 filtering facepiece respirators, and gloves.
- Patients must wear a surgical mask before being referred to the nuclear medicine unit. Gloves are suggested and hand cleaning is mandatory. Suspected or verified COVID-19 patients must have full protection.
- All nuclear medicine units should have a separate external area for supplying surgical masks, hand cleaning lotions, and gloves to every person who enters the unit. Everyone must be considered a patient in the latency period.
- A checkpoint at the hospital entrance should be in place to monitor the body temperature of patients, workers, and visitors. Few questions should also be asked whether the person had sore throat, cough, or have been in contact with infected persons. This control should be repeated when a patient enters the nuclear medicine unit. In countries where it is accepted, the patients who refer to the nuclear medicine units should fill out a verified online screening test for coronavirus infection and show the results of the online tests to the checkpoint at the unit/hospital entrance.

Conclusion

The pandemic SARS-CoV-2 disease is spreading rapidly. Healthcare workers and others must take protective and preventive measures to reduce the probability of contagion. All staff in nuclear medicine units must follow the national and local official recommendations and guidelines to lower the risk of transmission. Recording and assessing all our experiences and lessons about COVID-19 daily will be a valuable exercise, helping to guide the management of the coronavirus pandemic. Case designations are dynamic, and consequently, front-line doctors are strongly urged to seek updates from

public health and infection control authorities as our understanding of this disease matures. One more important point that we should not forget in this situation is this fact that this situation confines people to a small area and limits normal activity out of doors, which may lead to increased stress levels, restlessness, and the adverse consequences of physical inactivity. Psychological and behavioral supports could be helpful for the reduction of anxiety and negative moods, which could be important for increasing resilience during this disease outbreak.

Finally, it should be kept in mind that like other similar conditions, the most proper way to deal with any crisis is to be widely prepared. Up to now, it may believe that the performance of the healthcare system in nuclear medicine units is limited to radiation issues. This fact intensifies the necessity of nuclear medicine unit preparedness before an infection outbreak in addition to radiation accident. The development of an individualized management model for each nuclear medicine unit based on staffs, instruments, kind of services, crowding, physical space, hospital base unit, or outpatient clinic that could consider all managerial aspects of a crisis is of pivotal importance. The proposed response mode should have internal and systemic integrity and coherence among the included items in two intra- and inter-unit management categories. Besides, continuous training of different occupational staffs are among the key parameters in keeping the readiness and appropriate response of units to rare but extremely important probable infection outbreak.

Compliance with ethical standards

This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Nguyen TM, Zhang Y, Pandolfi PP. Virus against virus: a potential treatment for 2019-nCov (SARS-CoV-2) and other RNA viruses. Nat Publ Group. 2020;30(3):189–190.
2. Wu A, Peng Y, Huang B, Ding X, Wang X, Niu P, et al. Genome composition and divergence of the novel coronavirus (2019-nCoV) originating in China. Cell Host Microbe. 2020;27(3):325–328.
3. Sahin AR, et al. 2019 novel coronavirus (COVID-19) outbreak: a review of the current literature. EJMO. 2020;4(1):1–7.
4. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. Int J Antimicrob Agents. 2020;55(3):105924.
5. Goh GK, Dunker AK, Foster JA, Uversky VN. Rigidity of the outer shell predicted by a protein intrinsic disorder model sheds light on the COVID-19 (Wuhan-2019-nCoV) infectivity. Biomolecules. 2020;10(2):331. https://doi.org/10.3390/biom10020331.
6. Yeo C, Kaushal S, Yeo D. Enteric involvement of coronaviruses: is faecal–oral transmission of SARS-CoV-2 possible? The Lancet Gastroenterol Hepatol. 2020;5(4):335–337.
7. Dong N, Yang X, Ye L, Chen K, Chan EW, Yang M, Chen S. Genomic and protein structure modelling analysis depicts the origin and infectivity of 2019-nCoV, a new coronavirus which caused a pneumonia outbreak in Wuhan, China. bioRxiv. 2020 Jan 1.
8. Wang Z, Xu X. scRNA-seq profiling of human testes reveals the presence of ACE2 receptor, a target for SARS-CoV-2 infection, in spermatogonia, leydig and sertoli cells. 2020.
9. Zou X, Chen K, Zou J. The single-cell RNA-seq data analysis on the receptor ACE2 expression reveals the potential risk of different human organs vulnerable to Wuhan 2019-nCoV infection. Front Med. 2020.
10. Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, Cui J, Xu W, Yang Y, Fayad ZA, Jacobi A. CT imaging features of 2019 novel coronavirus (2019-nCoV). Radiology. 2020;4:200230.
11. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, Tao Q, Sun Z, Xia L. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. Radiology. 2020;26:200642.
12. Kanne JP, Little BP, Chung JH, Elicker BM, Ketai LH. Essentials for radiologists on COVID-19: an update—radiology scientific expert panel. 2020;27:200527.
13. Song Y, Zheng S, Li L, Zhang X, Zhang X, Huang Z, Chen J, Zhao H, Jie Y, Wang R, Chong Y. Deep learning Enables Accurate Diagnosis of Novel Coronavirus (COVID-19) with CT images. medRxiv. 2020.
14. Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, Ji W. Sensitivity of chest CT for COVID-19: comparison to RT-PCR. Radiology. 2020;19:200432.
15. Memish ZA, et al. Middle East respiratory syndrome corona virus, MERS-CoV. Conclusions from the 2nd scientific advisory board meeting of the WHO collaborating center for mass gathering medicine, Riyadh. Int J Infect Dis. 2014;24:51–3.
16. Centers for Disease Control and Prevention. Interim infection prevention and control recommendations for hospitalized patients with Middle East respiratory syndrome coronavirus (MERS-CoV). 2015-06-11). http://www.cdc.gov/coronavirus/mers/infection-prevention-control,html. 2015.
17. Memish Z, et al. Screening for Middle East respiratory syndrome coronavirus infection in hospital patients and their healthcare worker and family contacts: a prospective descriptive study. Clin Microbiol Infect. 2014;20(5):469–74.
18. Memish ZA, Al-Tawfiq JA. Middle East respiratory syndrome coronavirus infection control: the missing piece? Am J Infect Control. 2014;42(12):1258–60.
19. World Health Organization. Rational use of personal protective equipment for coronavirus disease (COVID-19): interim guidance, 27 February 2020. World Health Organization; 2020.
20. Brosseau LM, Jones R. COMMENTARY: Protecting health workers from airborne MERS-CoV—Learning from SARS. Center for Infectious Disease Research and Policy. Posted May. 2014;11:19.
21. Hosseiny M, Kooraki S, Gholamrezanezhad A, Reddy S, Myers L. Radiology perspective of coronavirus disease 2019 (COVID-19): lessons from severe acute respiratory syndrome and Middle East respiratory syndrome. American Journal of Roentgenology. 2020;28:1–5.
22. Food and H. Drug Administration. Banned devices; powdered surgeon's gloves, powdered patient examination gloves, and absorbable powder for lubricating a surgeon's glove. Final rule. Fed Regist. 2016;81(243):91722.
23. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in

China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. Jama. 2020;24.
24. Tavakoli A, Vahdat K, Keshavarz M. Novel coronavirus disease 2019 (COVID-19): an emerging infectious disease in the 21st century. ISMJ. 2020;22(6):432–50.
25. Huang HL, et al. COVID19–nuclear medicine departments, be prepared! Nucl Med Commun. 2020;41(4):297–9.
26. Chinese Society of Nuclear Medicine, E.B.o.C.J.o.N.M.a.M.I. Corresponding Author: Li Sijin. Chin J Nucl Med Mol Imaging. 40(3).

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