Proactive Response of Nuclear Medicine Department in Current Coronavirus Disease-19 Pandemic

Sir,

The current coronavirus disease-19 (COVID-19) epidemic has affected every field of life internationally. Business, politics, trade, and education have been shut down to prevent loss of lives and limit the transmission. Radiology has played a vital role in the initial evaluation of effected patients, especially in reverse transcription–polymerase chain reaction-negative cases; however, the current focus of most medical imaging departments has shifted from diagnostic capability to preparedness.[1,2]

The current letter suggests a possible response of nuclear medicine departments during the current pandemic regarding the management of workflow. Given the circumstances, nuclear medicine workflow can be divided into nonurgent, urgent, and equivocal cases to reduce the risk of transmission of infection among the population. A general workflow management for the nuclear medicine department and its potential role in the current pandemic is discussed in Table 1.

Alternate Radiotracers in Case of Shortage of Tc-99m Supply

In case of nonavailability of Tc-99m generators, all main oncology bone and cardiology scans can be shifted to positron emission tomography/computed tomography (PET/CT) as per the current SNM and EANM guideline, keeping in view the reimbursement issues [Table 2].

Incidental Findings of Coronavirus Disease-19 during Normal Flow

Incidental pulmonary inflammatory findings during oncology PET/CT may be cautiously interpreted. In case of lower lobe/peripheral predominant, multiple, bilateral ground-glass opacities, crazy-paving, air bronchograms, a reversed halo pattern is highly suggestive of COVID-19 infection rather than non-COVID-19 pathology.[3,4]

Explorative Research Activities for Coronavirus Disease-19 Imaging

Looking at the current picture, nonimaging diasporas, i.e., multinational companies, have poured billions of dollars to deal with COVID-19 pandemic, focusing to develop new diagnostic tools and curative therapies. Highly sensitive molecular imaging using ^{18}F-fluorodeoxyglucose (^{18}F-FDG) has not been widely explored due to its high cost and theoretically is being labeled as of limited role without any large randomized controlled trials. Based on the diversity of the viral behavior limiting initial detection and equivocal postrecovery period diagnostics, it is suggested that large randomized controlled trials should be conducted to establish the role of ^{18}F-FDG, especially in initial diagnostic triage to detect early pneumonitis and in follow-up setting to evaluate residual/recurrent disease and monitoring response to therapy.[5]

In acute lung injury, the rate of ^{18}F-FDG uptake reflects the state of inflammatory process activation, i.e., C-reactive protein, CD4, CD8, and interleukin-6, pointing to an acute inflammatory response.[6,7] COVID-19 infection is believed to comprise the initial infiltration of inflammatory cytokines into the lung, followed by delayed morphological changes that are apparent on HRCT approximately 4–5 days postinfection with a peak reported between 6 and 11 days.[8] The cost of trials may be covered through multiple agencies in the world ready to fund the COVID-19 research; however, it is a fact that in the gulf region, ^{18}F-FDG is free of cost for the nationals.

Staff and Department Safety

All radiology staff dealing with suspects must practice proper PPE, fluid-resistant (Type IIR) surgical face masks, filtering facepiece (Class 3) respirators, disposable eye protection, preferably visor, long-sleeved gown, gloves, scrubs, and strict hand hygiene. Separate gamma-cameras can be dedicated for COVID-19-confirmed or COVID-19-suspected cases with management of physicians in teams/groups so that in case of any COVID-19 suspicion, other teams may continue the department flow. Postimaging deep cleaning procedures must be adopted using chlorine-based antiseptics and ultraviolet light (if available) for 60–90 min. Patient waiting areas must be cleaned every 3–4 h. A continuous flow of air must be maintained to avoid air stagnation.

Online Reporting

Keeping minimal nuclear medicine physicians on-site, the department can offer online reporting through cloud-based image processing stations, i.e., MIM™.

Future of Nuclear Medicine in Coronavirus Disease-19 Pandemic

The current epidemic has brought the humanity down on the knees, but we should fight united against the current pandemic in our respective domains. If this would have happened two decades back, nuclear medicine would have been locked down, but now, as we have highly sensitive

Table 1: Suggested nuclear medicine workflow in current COVID-19 pandemic

Suggested cancellation

C14-UBT, salivary gastric emptying, morphine HIDA, red cell mass, colonic transit sincalide HIDA, CSF studies, dacroscintigraphy, small-bowel transit, lymphoscintigraphy, and proctoscintigraphy

Suggested continuation

GI bleed study, Meckel's, lung perfusion (SOB), oncology new cases (^{18}F-FDG), preoperative SLN, GFR/DMSA, Y90-SIRT, MPS with acute chest pain, radium-223, Lu-177 DOTATATE, MUGA oncology, amyloid DPD, MPS (chest pain), octreotide/tektrotyd, Ga-68 DOTATATE (staging/therapy, decision), ^{68}Ga PSMA/^{18}F-choline (new case), thyroid Tc-99m/I-123 (adults)

Equivocal cases

MPS routine, white cell use alternate FDG PET/CT, Tl-201 hibernation, ^{68}Ga-PSMA/F-18 choline follow-up cases, lung VQ, MIBG pheochromocytoma, MUGA – cardiac, parathyroid, MAG-3, thyroid Tc-99m/ I-123 (pediatrics), ^{68}Ga-68 DOTATATE follow-up, Ga-68 PSMA follow-up, F-18 FDG follow-up, DaTscan, MIBG heart, general bone scan

Radionuclide therapies

Benefit-to-risk ratio be discussed with the treating physicians, and each patient needs to be assessed at individual basis. Benign I^{131} therapy can be delayed except for those who cannot tolerate ATT and have comorbid conditions. ^{177}Lu and alpha therapies can be done on OPD basis if the dose is available

CSF: Cerebrospinal fluid, GI: Gastrointestinal, ^{18}F-FDG: ^{18}F-fluorodeoxyglucose, GFR: Glomerular filtration rate, PET: Positron emission tomography, CT: Computed tomography, OPD: Outpatient department, HIDA: hepatobiliary iminodiacetic acid, SOB: shortness of breath, SLN: Sentinel lymph node, DMSA: Dimercapto succinic acid, SIRT: Selective Internal Radiation Therapy, MPS: Myocardial perfusion study, MUGA: Multigated acquisition, DPD: 3,3-diphosphono-1,2-propanodicarboxylic acid, PSMA: prostate specific membrane antigen, MIBG: Meta-iodo benzyl guanidine, MAG-3: Mercaptuacetyltriglycine, ATT: Antithyroid therapy

Table 2: List of alternative approved imaging tracers

Primary radiotracer	Alternate radiotracer	Regions	Reference
^{99m}Tc-MDP (prostate and nonprostate)	^{18}F-NaF PET/CT	Skeletal imaging, tumor imaging, infection/inflammation imaging[5]	EANM
^{99m}Tc-sestamibi 99mTc-tetrofosmin	Thallous chloride-201	Myocardial perfusion imaging[9]	EANM
	^{18}F-FDG PET/CT		
	^{82}Rb (rubidium chloride)		
^{99m}Tc-MDP (prostate cancer)	^{68}Ga-PSMA	Prostate cancer[10]	Joint EANM and SNMMI
	^{11}C-Acetate		
	^{11}C-Choline		
	^{13}N (ammonia)		
^{99m}Tc-HYNIC-TOC	^{68}Ga-DOTA-TOC	Neuroendocrine tumors[11]	EANM
	^{68}Ga-DOTA-NOC, 68Ga-DOTA-TATE		
^{99m}Tc-HMPAO	^{18}F-FDG	Neurodegenerative disease, cerebrovascular disease, epilepsy, brain tumors, brain inflammation and infections	EANM[12]
^{99m}Tc-ECD			
^{99m}TcO4	^{123}Iodine	Thyroid scan	EANM/SNM
^{99m}Tc-DTPA	^{123}I (sodium iodohippurate)	Renal function	EANM/SNM
^{99m}Tc-sulesomab	^{111}Indium, ^{67}Gallium	Inflammation/infection	EANM/SNM
^{99m}Tc-labeled WBCs			

WBCs: White blood cells, NAF: Sodium fluoride, PET: Positron emission tomography, CT: Computed tomography, ^{18}F-FDG: 18F-fluorodeoxyglucose, MDP: methyl diphosphonate, HYNICTOC: ethylenediamine N, N'-diacetic acid/hydrazinonicotinamide-Tyr3-octreotide, HMPAO: hexamethylpropyleneamine oxime, ECD: ethyl cysteinate dimer, DTPA: diethylene-triamine-pentaacetate, PSMA: Prostate specific membrane antigen, EANM: European Association of Nuclear Medicine, SNM: Society of nuclear medicine, SNMMI: Society of nuclear medicine and molecular imaging

targeted radio-tracers with high-tech state of the art digital gamma-cameras, nuclear medicine should be proactive and should take the responsibility to a level to be able to answer the questions of humanity using molecular radiology.

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Conflicts of interest

There are no conflicts of interest.

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