

RADIOLOGY SERVICES GUIDELINES IN THE MANAGEMENT OF SUSPECTED, PROBABLE AND CONFIRMED COVID-19 PATIENTS

1. INTRODUCTION

- 1.1 Radiology department and its mobile imaging units are sites of high patient contact and thus must engage in meticulous infection control practices to prevent the transmission of the infectious organisms within the hospital.
- 1.2 Radiology staffs need to understand the various routes of infection transmission and implements transmission-based precautions when necessary to protect patients and other staff. Infection control steps that are relevant to the radiology department includes exercising proper contact precautions, performing adequate environmental cleaning, and ensuring staff adherence to infection control policies through education and monitoring.
- 1.3 Wherever possible, the imaging for suspected, probable and confirmed Covid-19 patients should be done with mobile units at bedside or designated location. With the ongoing Covid-19 pandemic, there is an increasing demand in the utilizations of special radiological examination especially CT scan.
- 1.4 The radiology department need to re organized a new workflow to accommodate to this new demand to support the management of suspected, probable and confirmed Covid-19 patients

2. INFECTION PREVENTION & CONTROL (IPC) MEASURES DURING RADIOLOGICAL PROCEDURES

2.1 To limit exposure of staff and patient to COVID-19 infection:

- 2.1.1 Training on infection prevention and control including appropriate personal protective equipment (PPE)
- 2.1.2 Point of entry screening of patient for elective cases
- 2.1.3 Monitoring well-being of radiology staff.
- 2.1.4 Hybrid working team to ensure sustainable radiology operation.
- 2.1.5 Skeleton (minimum number) staff to work per modality.

2.2 Implementing SOP for suspected, probable or confirmed COVID-19 patient

- 2.2.1 The hospital authorities to recommend the flow of the patient from the ward to the Radiology Department.
- 2.2.2 The security guards must be involved to manage the patient flow.
- 2.2.3 All requests for radiological examinations shall be pre-registered prior to receiving case.
- 2.2.4 The primary team staff shall call and inform the radiology personnel of the exam to be performed.
- 2.2.5 Wherever possible, the exam shall be performed in a designated location.
- 2.2.6 General radiography and ultrasound shall be done at the bedside to minimize patient movement
- 2.2.7 For special examination (CT/MRI/Angio), the suspected, probable or confirmed COVID-19 patient shall be scheduled at latter part of the day after completion of non-infectious cases.

2.3 Reducing potential transmission from suspected, probable or confirmed COVID-19 patient

- 2.3.1 Wherever possible the entrance to the Radiology Department is preferably through a different access.
- 2.3.2 Patient shall only be sent to Radiology Department upon receiving a call from radiology staff to minimize contact time in Radiology Department.
- 2.3.3 Patient should be taken back from Radiology Department to the respective wards as soon as the examination is completed.
- 2.3.4 Suspected, probable or confirmed COVID-19 patient should wear a surgical mask during transport in and out of the Radiology Department
- 2.3.5 The radiology personnel shall take all necessary infection control precaution in accordance with Infection Control guideline. They should wear appropriate personal protective equipment depending on the status of the patients either airborne or droplets precaution.

2.3.6 The Radiology personnel in charge of modality shall allow sufficient time off for disinfection of equipment in between the cases.

2.3.7 Disinfection of CT scanner gantries, MRI gantries, angiography machines, ultrasound machine including probes, blood pressure cuffs, the image viewing station mouse and keyboards, and other tools after every contact with suspected, probable or confirmed COVID-19 patient shall be carried out. The Radiology department staff should contact vendors to identify the best disinfectant to be used for each piece of equipment.

2.3.8 The modalities used in the management of suspected, probable or confirmed COVID-19 patient apart from general radiography depends on the availability of equipment at the local set up.

2.3.9 A multidisciplinary committee at local level shall convene to outline the guidelines for radiology personnel to prevent the virus from spreading through human-to-human contact and the department equipment.

3. SOP FOR PERFORMING RADIOLOGICAL PROCEDURES DURING COVID-19 PANDEMIC

3.1 Mobile X-Ray

- Request made manually or online
- The ward staff shall call and inform the imaging personnel of the examination to be performed.
- An appropriate time is determined for the examination to be carried out.

3.1.1 Pre-examination Preparation

a. Registration

- All request for radiological exam shall be pre-registered prior to receiving the patient.

b. The Radiographer

- The radiographers have to abide by the precautions outlined by the Infection Control Guidelines on the necessary steps to limit COVID-19 transmission. (It is recommended to have a core number of radiographers trained for this exercise).

- c. Lead gowns
 - To clean on both sides (front and back).
 - To be worn before the Radiographers wear the PPE.
- d. Mobile x-ray Machine
 - To clean the mobile x-ray machine especially the wheels.
- e. X-Ray cassette / detector
 - Clean on both sides (front and back)
 - Cover the cassette with two layers of disposable plastic bags.
- f. Anatomical Markers
 - Clean on both sides
 - To place the anatomical marker onto the first/inner plastic layer.
- g. Donning of PPE
 - According to type of precaution (as per recommended by ANNEX 8 PPE guideline)
 - Donning at the designated area

3.1.2 Performing the examination

The radiographer shall be assisted by a ward staff in:

- opening the door/s if a patient in a room
- help in positioning the patient for the x-ray examination

3.1.3 Post examination

a. The radiographers shall be assisted by a ward staff in:

- Removal of the cassette/detector from under the patient
- Removal of the cassette/detector from the contaminated plastic bags (outer/second layer)
- Dispose this bag into the yellow clinical waste bin)
- Opening of the exit door/s if patient in a room.

- b. Remove the outer layer glove
- c. Place cassette/detector at mobile machine or trolley
 - i. Disinfect the mobile X-ray machine
 - by the radiographers as per recommendation before doffing.
 - at designated area
 - wipe the mobile x-ray machine with sanicloth or as per manufacturer recommendation.
 - wheels to roll over the sticky mat or an alcohol soaked cloth
 - ii. Doffing of PPE
 - iii. Remove the anatomical marker and disinfect anatomical marker
 - iv. Remove the inner/first layer plastic cassette/detector cover
 - v. Wipe the cassette/detector
 - vi. Process the image

3.2 Mobile Ultrasound

3.2.1 The hospital authorities should assign or acquire one machine for mobile ultrasound examination purposes.

3.2.2 Pre procedure machine preparation

- a. Clean the ultrasound machine before and after the procedure
- b. Advice to cover especially the monitor, keyboard and/or touch screen with a transparent plastic sheet.
- c. Cover the ultrasound probe.

3.2.3 Performing examination

- a. Donning of PPE in pairs before performing the examination
- b. Print images (if required) at clean area.

3.2.4 Post Procedure

- a. Remove the probe cover, keyboard cover, monitor cove, outer layer apron then outer layer glove (in this sequence).
- b. Wheels to roll over the sticky mat, disinfectant spray or an alcohol soaked cloth.

- c. Doffing of PPE at designated area.

3.3 Special Examinations (CT/MRI)

3.3.1 Pre procedure

- a. Receive order of examination either online or manual
- b. Cases shall be scheduled at a later part of day preferably after completion of elective list except in emergency cases.
- c. Wherever possible, use a separate access route to the department.
- d. The case shall be pre-registered before being called.
- e. Accepting Radiology doctor to inform Radiographer in Charge.
- f. The patient shall only be sent to the examination after being called by the radiology personnel to minimize contact time in Radiology Department.
- g. Radiographer in charge to inform;
 - i. Ward (time of procedure and accompanying personnel)
 - ii. Security guard to clear and mark the pathway
 - iii. Hospital concession company for terminal cleansing
- h. Provide good ventilation (i.e. open doors and windows) if the examination room is not under negative pressure.
- i. Patient status and accompanying staff
 - i. Ventilated or on Oxygen mask
Doctor, staff nurse/ MA - PPE: Refer to ANNEX 8 PPE guideline
 - ii. Non ventilated (patient able to wear surgical mask).
Staff nurse - PPE: Refer to ANNEX 8 PPE guideline
- j. Radiology preparation

- i. Staff: 2 Radiographer (1 in clean and 1 contaminated area), 1 MO, 1 Radiologist
- ii. Remove non-essential equipment from the examination room
- iii. To cover the contact surfaces of equipment in the examination room with plastic cover or sheet. (contact surfaces includes: gantry control panel, monitor, contrast injector and examination couch)
- k. To load IV contrast media into injector before patient's arrival (if needed)
- l. Radiographer in clean area to call ward to send patient
- m. Patient to use designated route/lift to radiology department
- n. Check and verify patient preparation / consent
- o. Recheck blood results, last meal, allergy etc
- p. Check patient's particulars and consent given if appropriate

3.3.2 Performing procedure

- a. To perform as per protocol
- b. If IV contrast is required, radiology doctor to check IV line patency and need to wear the appropriate PPE (as per ANNEX 8 PPE guideline).
- c. Accompanying staff to assist in patient transfer.

3.3.3. Post Procedure

- a. To monitor patient in angio suite for complications and manage if present, prior to transfer back to the ward
- b. Radiographer in clean area to inform security guard that patient is going back to the ward
- c. If case requires contrast injection, the radiographer in contaminated area will remove the injector line in full PPE.
- d. Accompanying staff to assist in transferring the patient.

- e. Radiographer in contamination area to remove the equipment covers and to clean the machines.
- f. Doffing at the designated area.
- g. Hospital cleaner to perform terminal cleaning of the Room (*according to patient's status i.e. Suspected /Confirmed COVID-19/On Oxygen/ Ventilated etc.)

3.4 Special Examinations (Angio)

3.4.1 Pre procedure

- a. Receive order of examination either online or manual
- b. Cases shall be scheduled at a later part of day preferably after completion of elective list except emergency cases.
- c. Wherever possible, use a separate access route to the department.
- d. The case shall be pre-registered before being called.
- e. Accepting Radiology doctor to inform Radiographer in Charge.
- f. The patient shall only be sent to the examination after being called by the radiology personnel to minimize contact time in Radiology Department.
- g. Radiographer in charge to inform (*):
 - i. Ward (time of procedure and accompanying personnel)
 - ii. Security guard to clear and mark the pathway
 - iii. Hospital concession company for terminal cleansing
- h. Provide good ventilation (i.e. open doors and windows) if the examination room is not under negative pressure.
- i. Patient status and accompanying staff
 - i. Ventilated or on Oxygen mask
Doctor, staff nurse, MA - PPE: as per ANNEX 8 PPE guidelines
 - ii. Non ventilated (patient able to wear surgical mask).
Staff nurse - PPE: as per ANNEX 8 PPE guidelines

3.4.2 Radiology preparation:

- a. Staff: 2 Radiographers (1 in clean and 1 in contaminated area) , 1 MO or Fellow, 2 nurses (1 assist, 1 runner), 1 Interventional Radiologist and Anesthesia team (for ventilated / sedation/GA cases)
- b. PPE for interventional radiology team performing ventilated suspected, probable or confirmed Covid-19 patient to follow Infection control measures/ PPE for healthcare workers when performing aerosol generating procedures as per Annex 8
 - c. Remove non-essential equipment from the examination room
- d. To cover the contact surfaces of equipment in the examination room with plastic cover or sheet. (contact surfaces includes: table or remote control panel, monitor, contrast injector and examination couch)
- e. To load IV contrast media into injector before patient's arrival (if needed)
- f. Radiographer in clean area to call ward to send patient. Patient to use designated route/lift to radiology department
- g. Check and verify patient preparation / consent
 - i. Recheck blood results, last meal, allergy etc.
 - ii. Check patient's particulars and consent

3.4.3 Performing procedure

- a. To perform as per protocol
- b. Accompanying staff to assist in the patient transfer.

3.4.4 Post Procedure

- a. To monitor patient in angio suite for complications and manage if present, prior to transfer back to the ward.
- b. Radiographer in Clean area to inform security guard that patient is going back to the ward
- c. If case with contrast injection, the radiographer in contaminated area will remove the injector line in full PPE.

- d. Accompanying staff to assist in transferring the patient.
- e. Radiographer in contaminated area to remove the equipment covers and to clean the machine/s.
- f. Doffing at the designated area.
- g. Hospital cleaner to perform terminal cleaning of the Room (*according to patient's status ie suspected/positive Covid-19/On Oxygen/ Ventilated etc

**** Hand hygiene with alcohol rub must be performed before and after each step during doffing post procedure.**

4. WORK FLOW OF SENDING COVID-19 PATIENT TO RADIOLOGY DEPARTMENT

- 4.1 Prepare patient and examination room
- 4.2 Patient shall only be send to Radiology Department upon receiving a call from radiology staff to minimize contact time in Radiology Department. (if possible to delay after Office Hour to minimize contact with non-essential staff)
- 4.3 Alert Security Floor
- 4.4 Provide good ventilation (i.e. open doors and windows) if the examination room is not under negative pressure.
- 4.5 The work flow of the process of sending the COVID-19 patient to radiology Department is shown in Figure 1

5. SETTING OF RADIOLOGY EXAMINATION ROOM AND STAFF POSITIONING

- 5.1 Schematic of CT suite in the setting for suspected, probable and confirmed covid-19 patient's examination is shown in Figure 2.
- 5.2 Figure 3 shows the process and staff distribution in the CT scanner and console room during CT examination of suspected, probable and confirmed covid-19 patients.

WORK FLOW OF SENDING COVID-19 PATIENT TO RADIOLOGY DEPARTMENT

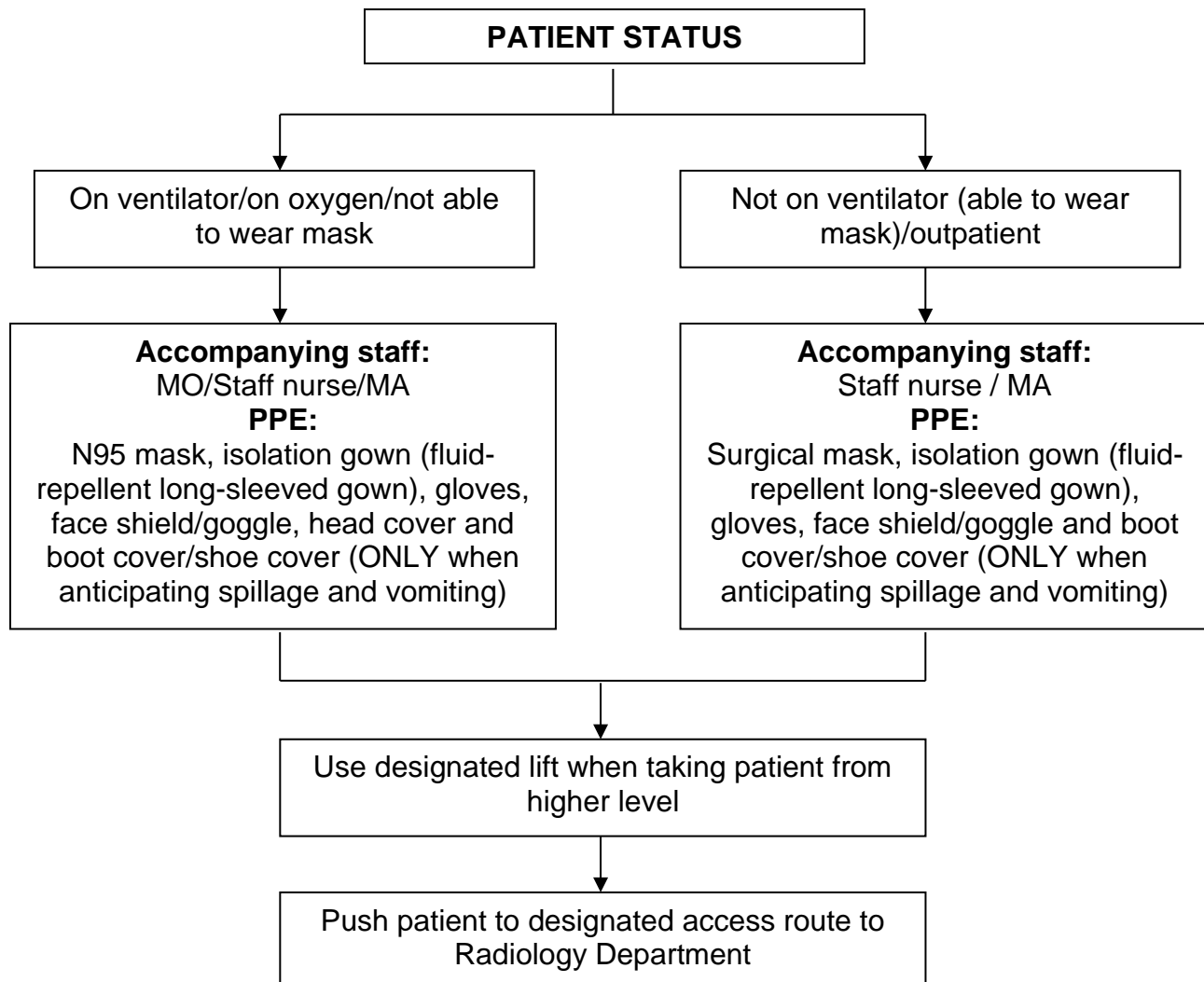


Figure 1: Work Flow of Sending Covid-19 Patient to Radiology Department

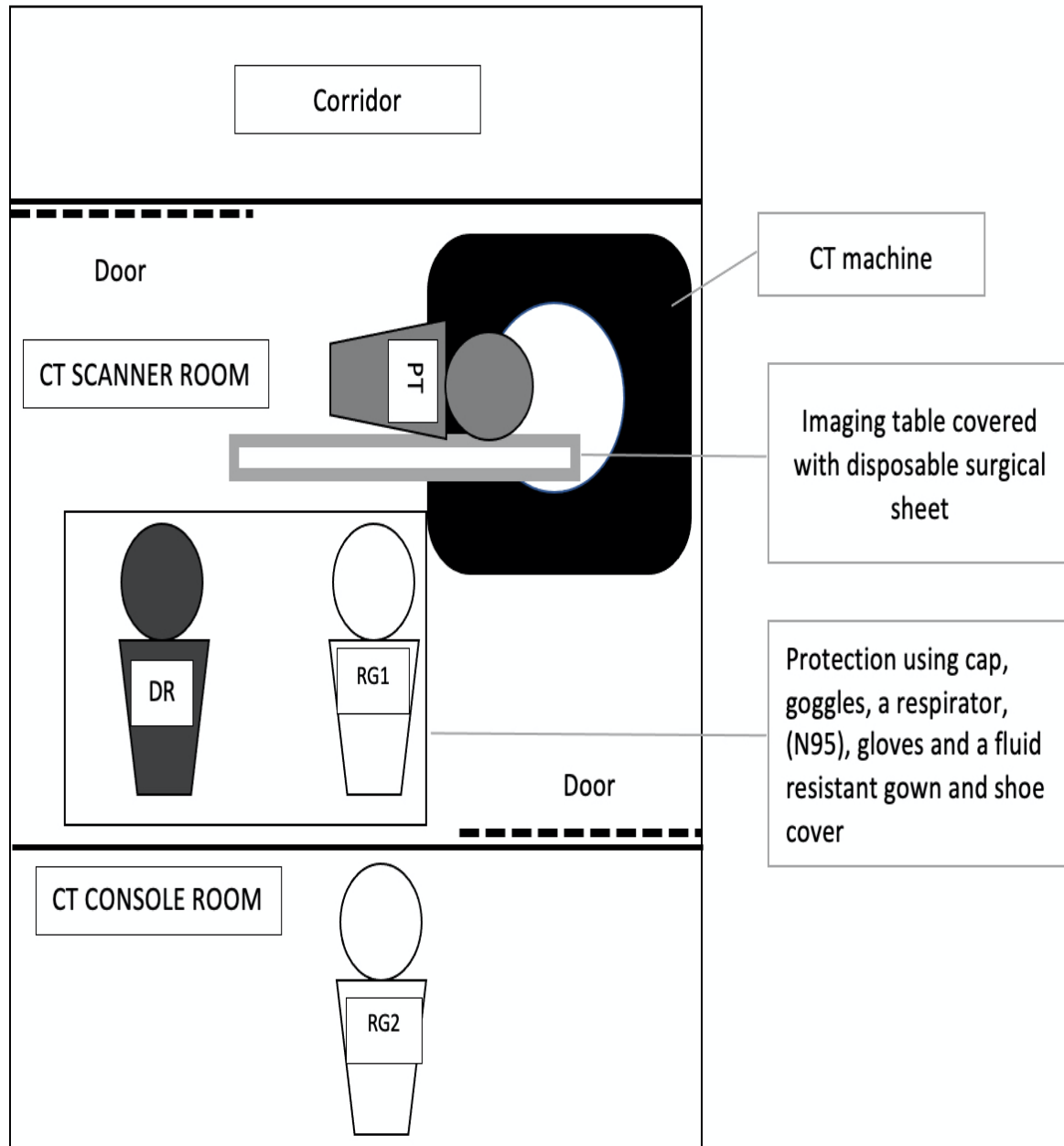


Figure 2: Schematic of CT suite in the setting for suspected, probable and confirmed covid-19 patient's examination

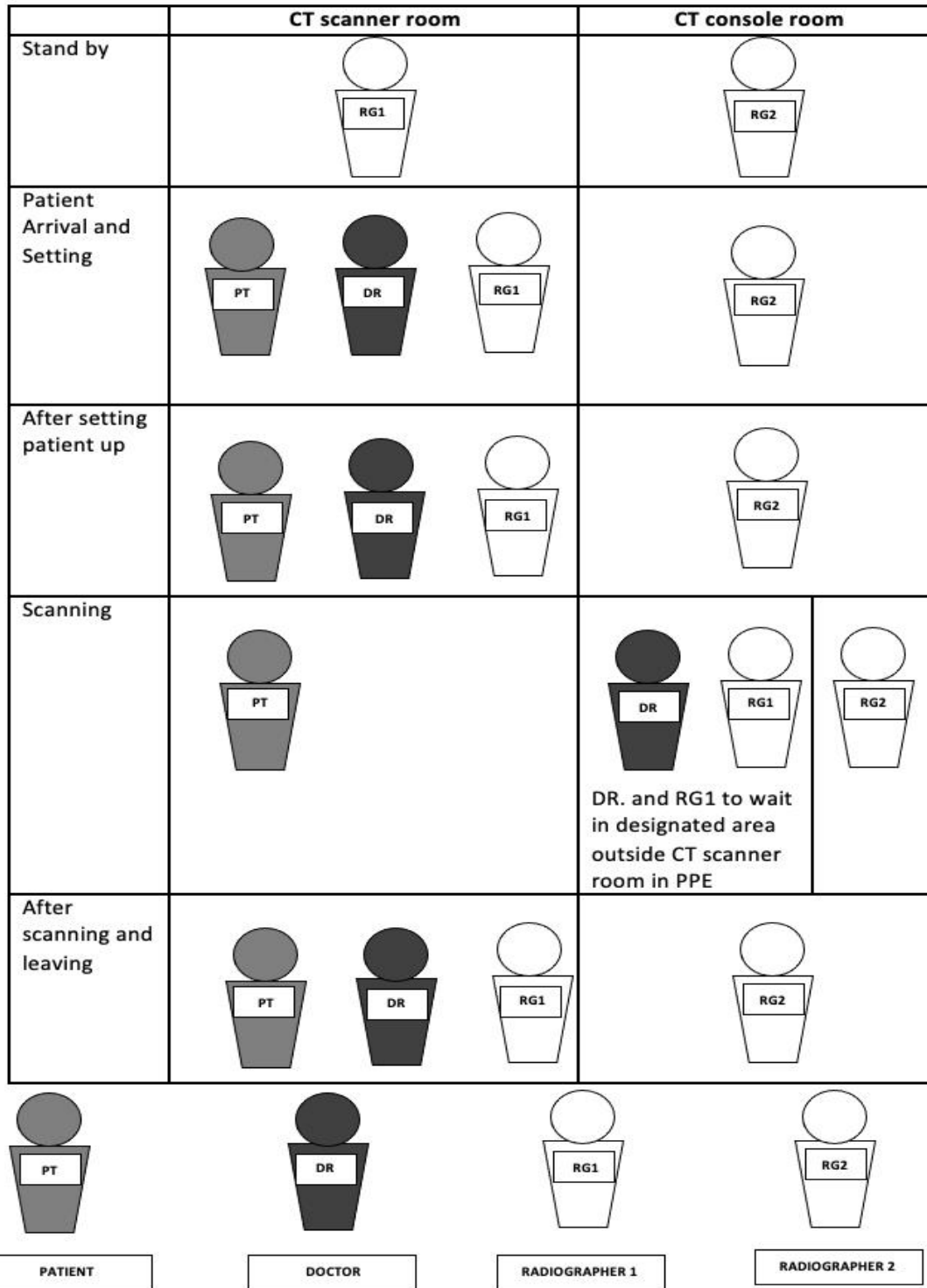


Figure 3: Process and staff distribution in the CT scanner and console room during CT examination of suspected, probable and confirmed covid-19 patients.

6. RECOMMENDED PPE FOR ATTENDING CLEANING PERSONNEL AND RADIOLOGY STAFF DURING THE PROCEDURE AND POST PROCEDURE

PPE FOR ATTENDING RADIOLOGY STAFF IN RADIOLOGY DEPARTMENT		
Ventilated/ On Oxygen/ not able to wear mask	Staff handling patient In examination room	N95, face shield /goggle, head cover, isolation gown, gloves, boot/ croc and shoe cover
	Staff handling control panel Outside examination room	N95
	Staff Outside/ Counter	N95
Patient not requiring oxygen (able to wear mask)	Staff handling patient in examination room	N95, face shield /goggle, head cover, isolation gown, gloves, boot/croc and shoe cover
	Staff monitor control panel Outside CT room	Surgical mask
	Staff outside/Counter	Surgical mask

END OF PROCEDURE

Send patient back to ward & call Hospital Concession company

- Terminal cleaning by Dedicated cleaner
- 1-hour downtime for passive air exchange

PPE FOR ATTENDING CLEANING PERSONNEL AND RADIOLOGY STAFF POST PROCEDURE IN EXAMINATION ROOM

Person under surveillance (PUS), suspected, probable or confirmed covid-19	1) Terminal cleaning (Concession company) - wall and floor 2) Radiographer -Disinfect equipment	N95, face shield/goggle, head cover, isolation gown, gloves and shoe cover.
--	--	---

Radiographer to clean the equipment in the Examination Room, monitors, keyboard in control room (frequently touched surfaces). Machine/equipment shall be cleaned using alcohol wipe, while monitor/ ultrasound probe to use non-alcohol wipe

REFERENCES:

1. Mahmud Mossa-Basha et al. Radiology Department Preparedness for COVID-19: *Radiology Scientific Expert Panel*; Radiology; Mar 20, <https://doi.org/10.1148/radiol.2020200988>
2. Kento Nakajima et al. COVID-19 pneumonia: infection control protocol inside computed tomography suites. *Japanese Journal of Radiology*; Mar 20; <https://doi.org/10.1007/s11604-020-00948-y>
3. Workflow of sending COVID-19 patient to radiology department Hospital Sungai Buloh by Infectious Disease Hospital Sungai Buloh, 2020.
4. Annex 24: Workflow and Work process for Radiological Examination during COVID-19 outbreak; Garis panduan pengurusan Covid-19 di Malaysia no. 5/2020
5. Abraham Kim, How can radiology can help limit COVID-19 transmission?; AuntMinnie.com