

Original Article

THE RADIOLOGY DEPARTMENT IN COVID-19 PANDEMIC: APPROACH AND OUTCOME AT A SEMI-URBAN TERTIARY HOSPITAL

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Abstract

Background: There has been an increase in the exposure of radiology staff worldwide in the first and second waves of the COVID-19 pandemic. To prevent the spread of disease to the frontline radiology staff, different departments have instituted diverse preventive and precautionary measures. However, the adaptability of the plethora of interventions available for the prevention of disease transmission depends partly on the socio-economic capability of the affected setting.

Objectives: To outline the approach and outcome of a radiology department in a resource-constrained setting at University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria, to the curtailment of disease transmission to the departmental staff.

Materials and Methods: An observational report on the approach for curtailment of COVID-19 disease transmission to departmental staff and the outcome, at the University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria. The approach utilized in such resource-constrained setting was observed between April 2020 and April 2021. This was documented by taking notes and pictures and the outcome presented.

Results: Eight cases of COVID-19 infection were recorded among 66 staff of the department. This is a case rate of 12.1%.

Conclusion: Our modest preventive measures helped reduce patient-to-staff and inter-staff transmission of COVID-19 virus to the minimum.

Keywords: COVID-19, Radiology department, Personnel protection, Nigeria.

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INTRODUCTION

The global pandemic tagged Coronavirus disease-2019 (COVID-19) started in December 2019 in Wuhan, Hubei Province of the Peoples Republic of China.¹ This disease is caused by a Ribonucleic Acid (RNA) virus known as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov2). The World Health Organization (WHO)

declared the disease a pandemic in January 30, 2020. Since then, it has affected over 190 countries with about 72 million cases and over 1.6 million deaths.²⁻⁴ The confirmed index case in Nigeria was detected in the Southwestern state of Lagos on 27 February 2020; since then, the number of confirmed cases nationwide rose to 164,719 and 2,062 deaths as of 27th April 2021.²⁻⁴ During

the first wave, there was an increased transmission to health workers with widespread panic in the health sector and many health facilities were shut down once a case was confirmed on their premises.

The index case in Ondo State, Southwest of Nigeria, was detected on 4th April 2020. As of 27th April 2021, the total number of reverse transcriptase polymerase chain reaction (RT-PCR) test confirmed cases in the state was 3,242, with 63 deaths.⁴ The state-owned University of Medical Sciences Teaching Hospitals (UNIMEDTH) which comprises three hospital complexes located in Akure (the capital city) and Ondo town; predominantly suburban settings, bore the brunt of the pandemic.

Radiodiagnosis plays a key role in the management of COVID-19 cases,⁵⁻⁸ especially in the tropics where communicable respiratory disease prevalence is very high and there is an emerging trend of increasing non-communicable chronic respiratory conditions.⁹ High-Resolution Computerised Tomography of the Chest (HRCT), especially when the pre-test probability of the disease is high, has become a useful tool in assisting physicians to categorise risk for COVID-19 while awaiting the result of reverse transcriptase polymerase chain reaction (RT-PCR).⁶

Since the announcement of the first case in Ondo State, our department has been actively involved in the evaluation of suspected cases. The hospital's standing protocol included triaging based on clinical presentation (cough, fever, breathlessness), history of contact with a confirmed case, travel to/from an endemic region, desaturation in room air, and HRCT scan for all suspected cases.

As the disease achieved pandemic proportions in January 2020, a global biting scarcity of personnel protective equipment (facemasks, protective gloves, goggles/face shields, and protective clothing) ensued.^{10,11} Gradually, industrial production of these items was ramped up, especially after the subsidence of the epidemic in China. Despite increased exports from China, there was scarcity in developing countries.¹⁰ The combination of the developed nations massive purchase of these protective equipment as well the low financial capability of the developing nations may have been responsible for the scarcity and made the latter's frontline healthcare

workers, on the average, poorly protected against the COVID-19 virus while rendering health services. There were donations of funds, protective equipment and ventilators to some African countries, which made little impact on healthcare workers needs for protection.^{10,11}

This is a report of our approach to healthcare personnel and patient protection during the first wave of the COVID-19 pandemic at our department of radiology. This article should be of help to other radiology departments grappling with the COVID-19 pandemic under similar circumstances.

METHODOLOGY

This is an observational report on the approach for curtailment of COVID-19 disease transmission to departmental staff and the outcome, at the University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria. The radiology department staff strength is 66 in the 3 complexes that make up our institution. The facility is resource constrained and the approach utilized to curtail COVID-19 disease transmission to departmental staff was observed between April 2020 and April 2021 by taking notes and pictures.

Below, the approach utilized is described, results are presented, discussed and conclusions and recommendations are made.

APPROACH

The general principles of radiation protection already established in radiology (Personnel Protection and Equipment, Distance, and Time)¹² were adapted to combat the pandemic.

Personnel Protection

Our hospital suffered a scarcity of protective gear. With increased role of our radiology department in the management of COVID-19 cases, wearing of facemasks by all patients and relatives passing through the Radiology department became compulsory. We also instituted the protection of the Radiology staff as follows;

Standard Protective Gear (Fig. 1A)

- Reusable Face Shields or protective goggles
- Disposable latex gloves.
- Face masks; N95 and KN95 varieties with respirators that were reused for up to 2 weeks

wearing cloth/non-surgical face masks underneath. The hospital infection prevention and control (IPC) team trained the staff on a procedure of dipping the masks in detergent solution, rinsing, and airing to dry. One-ply surgical grade facemasks were reused to a lesser extent.

- Non-reusable disposable surgical gowns
- Reusable surgical gowns that are worn once and sent to be cleaned in the CSSD

Specific Donning and Doffing Sequence

Because of the compact nature of the Radiology departments in the 3 complexes, there were **no**

demarcated ‘Donning/Doffing’ areas. Each active unit/room had specific closed lid plastic bins with foot pedals that were labelled “used” (**Fig. 1B**). These were placed in a remote corner of the rooms (areas with minimal traffic) and had 1.0m² perimeter box drawn on the surrounding floor. The worn gowns were placed in these as soon as they were taken off. The “sterile/unused” gowns were retrieved from a central bin storage in the departmental store by a health attendant (Sterile Health Attendant (SHA) designate for the day) and handed over to the staff. The process of donning follows the WHO and NCDC protocol.



Figure 1: Radiology staff wearing reusable gowns and other protective gears in the computed tomography room (A), and a closed lid plastic bin with foot pedal marked “Used gowns” for collecting “used” reusable and non-reusable gowns (B)

The process of doffing carries the highest risk of contamination and the following modified steps were strictly adhered to:

- Another staff must observe you during the process to spot any breach of transmission prevention.
- Wash or sanitise the outer pair of hand gloves before removal into the designated bin.

- Wipe the outer part of the face shield with sanitiser/detergent solution or alcohol wearing the internal pair of gloves. Do not remove the visor yet.
- Wipe the outer part of the reusable facemask same way as above. If it is a one-ply surgical mask, do not clean as described.
- Clean internal pair of gloves with sanitiser.
- Remove the gown (disposable or reusable) by grasping the inside of the collar and pull away from

your body rolling into a bunch. Then place in the 'Used' bin using the foot pedal.

- Remove the remaining pair of hand gloves and discard into the waste bucket.
- Wash your hands
- Remove visor into your desk drawer or designated place
- Remove face masks by pulling the cords over your ears (usually at the end of duty/shift on exit from the Radiology department). This is exposed to air or placed in the hot tropical sun for a few hours as is appropriate.
- Wash hands with water and solution.

Washing of hands

The department uses an alcohol-based hand sanitiser (Sterilium®) as well as the common dishwashing gel (Morning Fresh®) as anti-lipid washes. Washing of hands follows the specific WHO infectious disease control pattern at the faucet. Washing of hands is as needed but must be performed first as soon as the staff enters the department (there is also a hand sanitiser application at the hospital entrance) before wearing and after taking off the protective gear as described. Then after each hand gloves have been taken off and at the close of duty/shift.

Equipment

Unlike in some advanced countries where there is an abundance of equipment to create two parallel pathways for the patients seen in Radiology, the equipment in our department as in most sub-Saharan countries could not be divided to cater for suspected or confirmed COVID-19 and non-COVID-19 cases. To get around this problem, our centre resorted to the following:

- Covering of the Sonographic and Computerized tomography couches with disposable sheets for each patient
- Cleaning of the computerized tomography gantry, radiographic upright and horizontal and fluoroscopy tables with alcohol/bleach solution after each patient (even without suspicion of COVID-19).
- Fumigation of each room or suite by the PHA dressed in protective gear as directed by NCDC after a suspected COVID-19 case.
- Periodical fumigation of surfaces and floor (alcohol and bleach mixture in 2 litre aerosol gallons) in 4 to

Distance

- Prospective patients are seated in open corridors with good ventilation and a social distance of one meter.
- Prospective patients keep a distance of at least one meter from the Radiology department front desk. We designated this by a one metre perimeter box drawn on the floor.
- Only the 'active' member of the staff in a room stays less than 1 meter from the patient during the procedure after being properly dressed in protective equipment.
- Having such low staff strength creates problems. Unlike centres in which staff is grouped into 2 or more groups to cover the department separately, sadly this has not been tried in our centre. But the staff tries as much as possible to keep a safe physical distance between each other.

Time

The hospital has three active radiography suites. There are two separate suites in the Akure complex, one suite each in Ondo General and Main complexes (the main complex suite is a Radiographic/Specials/Fluoroscopic combination suite), five ultrasound rooms, and one computerized tomography machine/room. To prevent lengthy period of patient transit, work downtime and patient to patient and patient to staff disease transmission, the daily duties were modified, and we classified the procedures as those to run as clinics; those taken as high to low priority and those to be strictly on invitation.

The patients also spent minimal time as possible in the department for the procedures. The downtime after seeing a suspected COVID-19 case is rarely more than 30 minutes.

General procedural points

Patient Preparation

The standing hospital protocol by the Infection Prevention and Control (IPC) team is that all patients must be on a facemask, whether or not for COVID-19. Many of these patients are usually brought to the Radiology department on trolleys. The accompanying healthcare workers, usually from accident and emergency or critical

care don protective clothing. The patient is helped onto the narrow couch covered with a disposable sheet and laid supine. In the instance of a radiography procedure, the procedural room radiographer (different from the radiographer at the controls) goes into the procedure room and positions the patient and determines the planes and field of view to be taken. Patients' clinical parameters are usually monitored continuously in those critically ill. Some may require supplemental oxygen.

Post Procedure

The patient is immediately wheeled out of the Radiology department following the procedure. The disposable bedsheet is discarded safely. The gantry, couch, and floor are quickly wiped with the previously mentioned alcohol/hypochlorite solution and the suite room door is

left ajar to enable ventilation. The procedural room radiographer (who would have waited in the suite anteroom with the attending healthcare workers and not the controls radiographer) being the most contaminated doffs his protective gear first. The other Radiology staff follow suit.

RESULTS

The demography of the 66 personnel is shown in Table. 1. Despite the high exposure to COVID-19 from March 2020 during the first wave of the pandemic, we recorded the first confirmed case by reverse transcriptase polymerase chain reaction (RT-PCR) test in July 2020. Subsequently, seven more were confirmed. Two of the cases developed moderately severe symptoms and HRCT findings of lung changes. This is a case rate of 12.1%.

Table 1: Demographic and comorbidity pattern among departmental staff

VARIABLES	N=47	FREQUENCY	PERCENTAGE
AGE			
20-29		15	22.7
30-39		25	37.9
40-49		16	24.2
50 and Above		10	15.2
Mean Age = 37.4 ± 9.2 years			
Median = 35years			
Range = 24-67 years			
Mode = 50 years			
SEX			
Male		24	36.4
Female		42	63.6
COMORBIDITY			
Hypertension			
Yes		2	3.0
No		64	97.0
Diabetics			
Yes		1	1.52
No		65	98.48
Others			
Nil		100	100

DISCUSSION

The case rate of 12.1% is close to the 13.3% but lower than the 24% recorded among radiologists and radiology technicians at a German hospital;¹³ but higher than the 5.7% case rate at an interventional radiology division in New York, USA.¹⁴ Differences in infection rates among healthcare workers have been variously attributed to race (Black, Asian, and minority ethnic groups are more affected), spending longer time with patients, prolonged donning of gloves, age, and presence of comorbid chronic illnesses.^{15–18}

It is conceivable that the age distribution of our departmental personnel put most of the staff in the not-so-vulnerable age group, coupled with significantly low comorbidities. This is evidenced by the relatively young mean age of 37.4 ± 9.2 years and a low prevalence of pre-existing medical illnesses (Hypertension = 3%, Diabetes Mellitus = 1.5% among departmental personnel).

The measures implemented in our department are consistent (though modified) with the expert guidelines issued at the outset of the pandemic.^{19–22} The same pattern of modification to suit local peculiarities and varying degrees of compliance were observed at other radiology departments worldwide.²²

The main drawback of this study is the unavailability of comparative data on infections among the staff of other departments and among the patients seen in the department during this period. These were beyond the scope of our investigation.

CONCLUSION

We can conclude that our modest preventive measures helped reduce patient-to-staff and inter-staff transmission of COVID-19 virus to the minimum, with resultant availability of diagnostic radiology support in our hospital at the height of the first wave of the COVID-19 pandemic in Ondo state, Nigeria.

RECOMMENDATIONS

1. Based on the individual departmental requirements, some of the personnel protection concepts outlined in this paper should be institutionalised and adopted for routine use in the daily workflow of local radiology departments.

2. Self-sufficient local production of PPE should be a time-bound national objective.
3. Regular training and retraining of staff on the proper donning and doffing of PPE, standard handling of infectious cases, and decontamination of rooms/equipment.
4. Institutional planning towards obtaining dedicated imaging equipment for patients with confirmed or suspected COVID-19 or other contagious diseases.

AUTHOR CONTRIBUTIONS

AAA conceptualised the study and contributed to manuscript review. AOO designed and supervised the study and contributed to manuscript preparation, manuscript editing and manuscript review. JIF contributed to manuscript review. BMI conducted literature search and contributed to manuscript preparation, manuscript editing and manuscript review. ESO, OSO and FFA supervised guideline implementation and data collection and contributed to manuscript review. AOB, TAO and OAA collected data and contributed to manuscript review. CAA and OBO conducted statistical calculations and contributed to manuscript review. All authors read and approved the final draft of the manuscript.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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REFERENCES

1. Kim H. Outbreak of novel coronavirus (COVID-19): What is the role of radiologists? *Eur Radiol.* 2020;30(6):3266-3267. doi:10.1007/s00330-020-06748-2.
2. Odukoya OO, Adejimi AA, Isikekpei B, Jim CS, Osibogun A, Ogunsola F. Epidemiological trends of coronavirus disease 2019 in Nigeria: From 1 to 10,000. *Niger Postgrad Med J.* 2020;27(4):271-279. doi:10.4103/npmj.npmj_233_20.
3. Bowale A, Abayomi A, Idris J, et al. Clinical presentation, case management and outcomes for the first 32 COVID-19 patients in Nigeria. *Pan Afr*

- Med J.* 2020;35(Suppl 2):24. doi:10.11604/pamj.supp.2020.35.2.23262.
4. Nigeria Centre for Disease Control (NCDC). NCDC Coronavirus COVID-19 Microsite. Available from: <https://covid19.ncdc.gov.ng/>. Accessed April 27, 2021.
 5. Afolabi BI, Idowu BM, Onigbinde SO. Multimodality imaging of coronavirus disease 2019 (COVID-19): a pictorial essay. *Pol J Radiol.* 2020;85:e387-e393. doi:10.5114/pjr.2020.97957.
 6. Ai T, Yang Z, Hou H, et al. Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology.* 2020;296(2):E32-E40. doi:10.1148/radiol.2020200642.
 7. Mutala TM, Onyambu CK, Aywak AA. Radiology practice in sub-Saharan Africa during the COVID-19 outbreak: points to consider. *Pan Afr Med J.* 2020;37:28. doi:10.11604/pamj.2020.37.28.23081.
 8. Laamrani FZ, Chaibi A, Billah NM, et al. Reorganization of the imaging units in the context of the COVID-19 pandemic: experience of the Ibn Sina University Hospital in Rabat. *Pan Afr Med J.* 2020;35(Suppl 2):30. doi:10.11604/pamj.supp.2020.35.2.23239.
 9. Zumla AI, James DG. Immunologic aspects of tropical lung disease. *Clin Chest Med.* 2002;23(2):283-308, vii. doi:10.1016/s0272-5231(01)00005-3.
 10. Burki T. Global shortage of personal protective equipment. *Lancet Infect Dis.* 2020;20(7):785-786. doi:10.1016/S1473-3099(20)30501-6.
 11. Kea B, Johnson A, Lin A, et al. An international survey of healthcare workers use of personal protective equipment during the early stages of the COVID-19 pandemic. *J Am Coll Emerg Physicians Open.* 2021;2(2):e12392. doi:10.1002/emp2.12392.
 12. Bushberg JT, ed. *The Essential Physics of Medical Imaging.* 3rd ed. Wolters Kluwer Health/Lippincott Williams & Wilkins; 2012.
 13. Finkenzeller T, Lenhart S, Reinwald M, et al. Risk to Radiology Staff for Occupational COVID-19 Infection in a High-Risk and a Low-Risk Region in Germany: Lessons from the “First Wave.” *Rofo.* 2021;193(5):537-543. doi:10.1055/a-1393-6668.
 14. Gandras EJ, Greben CR. COVID-19 Infection Rate In Interventional Radiology Health Care Workers Within A Large Health System: Effectiveness of A Pragmatic Infection Control Mitigation Strategy. Available from: <https://tinyurl.com/24nykw2d>. Accessed July 23, 2022.
 15. Al Youha S, Alowaisih O, Ibrahim IK, et al. Factors associated with SARS-CoV-2 infection amongst healthcare workers in a COVID-19 designated hospital. *J Infect Public Health.* 2021;14(9):1226-1232. doi:10.1016/j.jiph.2021.08.012.
 16. Nguyen LH, Drew DA, Graham MS, et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health.* 2020;5(9):e475-e483. doi:10.1016/S2468-2667(20)30164-X.
 17. Bandyopadhyay S, Baticulon RE, Kadhum M, et al. Infection and mortality of healthcare workers worldwide from COVID-19: a systematic review. *BMJ Glob Health.* 2020;5(12):e003097. doi:10.1136/bmjgh-2020-003097.
 18. Martin CA, Pan D, Melbourne C, et al. Risk factors associated with SARS-CoV-2 infection in a multiethnic cohort of United Kingdom healthcare workers (UK-REACH): A cross-sectional analysis. *PLOS Medicine.* 2022;19(5):e1004015. doi:10.1371/journal.pmed.1004015.
 19. Idowu BM. Postgraduate radiology education in Nigeria: Looking backward and forward. *SA J Radiol.* 2018;22(1):1362. doi:10.4102/sajr.v22i1.1362.

20. Revel MP, Parkar AP, Prosch H, et al. COVID-19 patients and the radiology department – advice from the European Society of Radiology (ESR) and the European Society of Thoracic Imaging (ESTI). *Eur Radiol*. 2020;30(9):4903-4909. doi:10.1007/s00330-020-06865-y.
21. Mu L, Zhang C, Pei Y, Wang J. The worldwide coronavirus disease 2019 outbreak: Advice and recommendation on radiology management and
22. Tuite MJ. What Preparedness Advice for COVID-19 Did Radiology Departments Follow? *Radiology*. 2022;304(1):126-127. doi:10.1148/radiol.220362.