

Fever and Hypoxemia in an Era of High Risk for COVID-19 Infection: The Role of Chest Imaging With Chest Radiography and High-Resolution CT-Scan - Case Series

Authors: P. Shumbusho^{1,*}; P. Niyongabo¹; W. Mucyo², E. Rudakemwa²

Affiliations: ¹University of Rwanda, Kigali, Rwanda; ²King Faisal Hospital, Kigali, Rwanda

ABSTRACT

SARS-COV 2 is a betacoronavirus responsible for the 2019 pandemic (COVID-19). Fever is a major symptom and is frequently accompanied by what is recognized as rather characteristic radiological findings of bilateral, peripheral, multifocal and basal ground-glass opacities. To enlighten the health care professionals regarding these common findings in Rwanda, here, we review the clinical and imaging findings in 3 patients and provide an update of the current role and choices of imaging technology in COVID-19

Keywords: Coronavirus, Fever, Pandemics, High-Resolution Computed Tomography, CO-RADS.

INTRODUCTION

SARS-COV 2, thought to have originated from Wuhan, China, during the last months of 2019, causing a pandemic [1]. It is better known as Covid-19 (Corona Virus Disease 19). covid-19 is transmitted through respiratory droplets, and the median incubation period is about five days [1]. Since the pandemic started, Africa accounts for 1,149,940 cases, with 25,008 deaths, as of September 16th, 2020. Rwanda has registered 4,738 cases and 27 deaths, with a case fatality rate of 0.6%, as of September 22nd [2].

The common symptoms of COVID-19 infection include fever, dry cough, shortness of breath, fatigue, myalgia, nausea/vomiting or diarrhea, headache, weakness and rhinorrhea. Anosmia may be the sole presenting symptom in approximately

3% of individuals with COVID-19 [1]. Severe disease and increased mortality are associated with advanced age (≥ 60 years), comorbid conditions like diabetes mellitus, chronic lung disease, cancer and cardiovascular diseases [3].

COVID-19 is currently diagnosed by a real-time reverse transcriptase-polymerase chain reaction (RT-PCR) test of a nasopharyngeal specimen obtained with a swab. Chest imaging has been considered part of the diagnostic workup of symptomatic patients with suspected COVID-19 in a setting where RT-PCR testing is not available or results are delayed or are initially negative in the presence of symptoms attributable to COVID-19, as well as for the assessment of its related complications. Chest radiography is typically the first-line imaging modality performed in patients

***Corresponding author:** Patrick Shumbusho, MD. Johnsonpatrick65@gmail.com, Kigali-Rwanda; Tel : +250784105699; **Potential Conflicts of Interest (Col):** All authors: no potential conflicts of interest disclosed; **Funding:** All authors: no funding was disclosed; **Academic Integrity:** All authors confirm that they have made substantial academic contributions to this manuscript as defined by the ICMJE; **Ethics of human subject participation:** The study was approved by the local Institutional Review Board. Informed consent was sought and gained where applicable; **Originality:** All authors: this manuscript is original has not been published elsewhere; **Review:** This manuscript was peer-reviewed by three reviewers in a double-blind review process; **Type-editor:** Matthew (US)

Received: 03rd December 2020; **Initial decision given:** 14th June 2020; **Revised manuscript received:** 23rd January 2021; **Accepted:** 05th May 2021.

Copyright: © The Author(s). This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY-NC-ND) ([click here](#)) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. **Publisher:** Rwanda Biomedical Centre (RBC)/Rwanda Health Communication Center, P. O. Box 4586, Kigali. ISSN: 2079-097X (print); 2410-8626 (online)

Citation for this article: P. Shumbusho; P. Niyongabo; W. Mucyo, E. Rudakemwa et al. Fever and Hypoxemia in an Era of High Risk for COVID-19 Infection: The Role of Chest Imaging With Chest Radiography and High-Resolution CT-Scan - Case Series: A Case Series. Rwanda Medical Journal, Vol. 78, no. 2, pp. 9-13, 2021.

with suspected COVID-19 infection. However, it has limited use in confirming the diagnosis, given its low sensitivity. On the other hand, chest radiography may help stratify patients in terms of outcomes depending on the amount of pulmonary infiltrates [4]. Pulmonary consolidations and other pneumonia-related changes may be diagnosed as well as changes related to ARDS in patients who are critically ill. At the early stages of the disease and in mild cases, chest radiography findings may be normal [5,6].

Chest computed tomography (CT), especially high-resolution CT (HRCT), is important for detecting lung changes, density, and pattern of lung abnormalities caused by SARS-CoV-2. Predominant CT findings of COVID-19 infection are bilateral, peripheral, multifocal and basal predominant ground-glass opacities and/or consolidations [7]. CO-RADS (COVID-19 Reporting and Data System) provides a level of suspicion for pulmonary involvement of COVID-19 based on the features seen on a non-enhanced chest CT and has been shown to work well in clinical practice. The level of suspicion increases from very low (CO-RADS 1) to very high (CO-RADS 5). Two additional categories, CO-RADS 0 and CO-RADS 6, respectively, encode a technically insufficient examination and RT-PCR-proven SARS-CoV-2 infection at the time of examination [8]. CT scan is not routinely used given the radiation risk, time and cost; however, it is recommended in case of diagnostic uncertainty and when a differential diagnosis is considered [9]. The RT-PCR sensitivity is not optimal. Therefore, if combined with a CT scan may improve the diagnostic accuracy, especially when RT-PCR results become negative [10]. The low viral load and sampling technique can initially make the RT-PCR test negative. In this situation, the chest CT scan may help detect highly suspicious cases that need urgent treatment and isolation [11]. The CT scan sensitivity is high, especially in patients with positive RT-PCR, as opposed to conventional chest X-ray (86 to 97% versus 59%) [9]. Our aim in presenting these cases is to highlight the various clinical manifestations and radiological findings in COVID-19 patients and demonstrate the role of imaging.

Case 1: A 76-year-old female patient consulted with a seven-day history of dry cough, fever and shortness of breath. Her symptoms started with a

dry cough. Five days later, she started spiking fevers and progressive shortness of breath. She was treated with ceftriaxone at a neighborhood clinic for three days without improvement of her symptoms. She denied having body swelling, paroxysmal nocturnal dyspnea or orthopnea to suggest possible heart failure. Her past medical history is remarkable for well-controlled hypertension, with telmisartan and hydrochlorothiazide. No history of diabetes mellitus. She has a positive smoking history and reported no drug allergies.

On physical exam, she had mildly labored breathing with borderline oxygen saturation of 91% on room air but became hypoxic later on and a respiratory rate of 22 cycles per minute; she was afebrile during the hospital stay, with normal blood pressure and pulse rate. Her capillary glycaemia was 243 mg/dl (normal range: 70 to 110mg/dl). The chest exam was remarkable for bilateral expiratory wheezing and coarse crackles. The heart sounds were audible on auscultation; there was no added sound or murmurs. The jugular venous pressure was not raised, and the examination of the precordium was normal. The abdominal circumference was raised.

The initial laboratory workup revealed leukocytosis ($32 \times 10^9/L$ with neutrophilia, hemoglobin of 12.5 g/dL, and platelet count of $226 \times 10^9/L$). Inflammatory markers were elevated, erythrocyte sedimentation rate was 100 mm/hr. and C-reactive protein was 9.35 mg/dl. Two days later, a complete blood count showed declining white cell count, the peripheral smear showed toxic granulation and left shift but without blast or other leukemic cells. Urinalysis was unremarkable and the Genexpert sputum test was negative for *Mycobacterium tuberculosis*. Her biochemistry panel showed normal creatinine, urea, and electrolytes. Liver enzymes were two times the upper limit of normal, and albumin was borderline low. A high-resolution CT scan of the chest was done and revealed the findings in figure 1.

She was admitted to a high dependency unit for closer monitoring, working diagnosis being severe community-acquired pneumonia, differential diagnoses being COPD exacerbation, cor pulmonale, and hypertensive heart disease. Oxygen requirement was 15 liters/minute by mask to maintain SPO₂ above 90%.



Figure 1: HRCT-chest axial image

Demonstrates extensive bilateral ground-glass opacifications with interlobular/intralobular septal thickening (crazy-paving pattern) and thickened vessels within parenchymal abnormalities, predominantly in the peripheries. COVID-19 pneumonia is very highly suspected (CO-RADS 5).

The initial management included IV Amoxicillin-clavulanic acid and PO clarithromycin, PO prednisolone, intermittent nebulization with salbutamol, and subcutaneous enoxaparin for deep venous thrombosis prophylaxis.

COVID-19 RT PCR test was ordered. She received the above treatment for two days but remained oxygen-dependent. Bedside echocardiography revealed dilated right heart chambers and dilated inferior vena cava. On the above therapy, IV furosemide 20mg once a day was added for cor pulmonale. COVID-19 PCR result came back positive on day three of admission, the patient was still hypoxic but otherwise stable. She was referred for the continuation of care at a Covid-19 treatment center from which she was discharged after recovery two weeks later.

Case 2: A 37-year-old male who consulted for persistent fever and polyarthralgia for one week. It started with generalized malaise one week prior to presentation, with associated fever and polyarthralgia. He consulted the nearest facility and was diagnosed with malaria and received a three-day course of antimalarial with minimal recovery. Two days later, the fever persisted with intermittent episodes of dry cough, which prompted him to consult again after also taking the antibiotics for two days but without improvement. He denied any

associated gastrointestinal (GIT) upset, no urinary symptoms, and no headache reported. His past medical history was unremarkable and he has no recent travel history, occupation as a businessman, has no allergy to the medication or any food.

The physical examination revealed a temperature of 38.7° Celsius at presentation, SPO2: 93%, PR: 98 bpm, BP: 111/68.

Dry oral mucous membranes and no stigmata for anemia or chronic hypoxia.

The chest exam was notable for normal effort respiration and clear lungs, with normal heart sound, no added sound or a new murmur found

The abdominal examination was negative for organomegaly or any focal tenderness.

The treating team thought of: possible typhoid fever, leptospirosis or a deep abdominal abscess and rule out COVID-19.

After the initial laboratory workup, which included blood and urine cultures, he was initiated on IV ceftriaxone and IV fluid.

The workup revealed a normal Complete Blood Count (CBC), the renal function tests (urea and creatinine) and electrolytes were normal. He had elevated transaminases (two times the upper limit of normal) and elevated LDH 762IU/L (normal range:0-275IU/L). The rest of the liver panel was unremarkable. Septic workup included malaria which was negative quantitative CRP was elevated at 8.7 mg/dl.



Figure 2: HRCT-chest coronal image shows bilateral multifocal peripheral ground-glass opacities in both lungs, very highly suggestive of COVID-19 pneumonia (CO-RADS 5).

The initial COVID-19 antigen test was done and returned negative, but on the second day of hospital stay, he remained febrile and COVID-19 RT PCR was ordered, which returned positive.

A chest radiograph revealed bilateral infiltrates and was completed by high-resolution CT-scan for more characterization.

The treatment was adjusted by the addition of azithromycin and IV dexamethasone 6mg OD and the patient sent to the COVID-19 treatment center.

Case 3: 43-year-old male, consulted for a one-week history of persistent fever without any associated headache but reported non-significant dry cough and malaise but no shortness of breath, he tested negative for malaria and his blood count was remarkable for leukocytosis and neutrophilia 5 days before consulting our emergency for persisting fever. He denied any GIT discomfort and no urinary symptoms as well. His past medical history is notable for hypertension and Type-2 Diabetes Mellitus and a living renal transplant since 2018, now on immunosuppressive therapy (tacrolimus, MMF and prednisolone), and was taking vildagliptin for his diabetes.

On examination: he was afebrile, BP:123/75, SPO2: 88% at room air, PR: 110 bpm, and capillary glycaemia of 368mg/dl. He had a normal body habitus, not in distress and no stigmata for chronic hypoxia. There was left basal lung crackles on the chest exam and normal heart sound without any new murmur or added sounds has no features of volume overload rest of the systemic exam was normal.

His blood count was completely normal. The biochemistry panel showed normal renal function tests, liver enzymes were normal, albumin was in normal limits. He had an elevated quantitative CRP (21mg/dl) and a negative malaria smear. His HBA1C was 8.1%.

After the above clinical data, the patient was treated with IV ceftriaxone and clarithromycin as having bacterial pneumonia after taking blood cultures. He was initiated on IV hydrocortisone and immunosuppressive therapy was stopped. He remained stable apart from borderline hypoxia, and his COVID-19 RT PCR was back positive on

day two of admission and sent to isolation and treatment center.

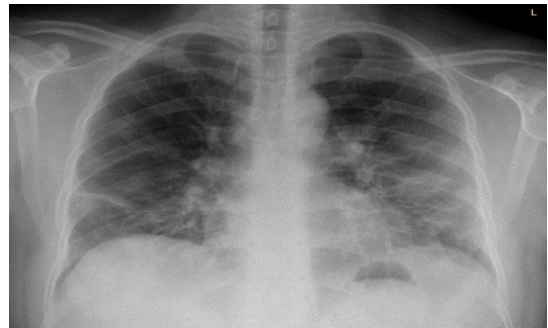


Figure 3: Chest radiograph demonstrates patchy ill-defined opacities in both lungs, predominantly in the peripheral regions, and nodular opacities in the right hilar and right paratracheal regions.

DISCUSSION

In a cohort of 41 patients admitted in Wuhan, China hospital, 98% had fever at presentation, and 13 patients (32%) had an underlying disease, mainly diabetes, hypertension and cardiovascular disease [12]. In the present series, all our patients had a fever and two of them had underlying diseases. COVID-19 tends to be more severe and fatal with advanced age. In the present series, the oldest patient was the sickest. There was no exposure to a seafood market in our cases instead of cases in China, and there was no need for ventilator support [13]. Renal transplant recipients are labelled as high risk for severe disease due to immunosuppressive drugs; in our cases, the renal transplant patient had a mild disease [14]. Gastrointestinal symptoms are widely reported in the literature. However, our cases did not show a similar presentation[15]. In the present series, the rapid antigen test tends to return negative and the RT-PCR turnaround time is long; therefore, the use of CT imaging dictate the next steps in management [11]. Predominant chest CT pattern of abnormality observed in a study done in Wuhan, China, by Heshui Shi et al. was bilateral (79% of 81 patients), peripheral (54%), ill-defined (81%), and ground-glass opacification (65%). This observation is in tandem with CT findings in our series [16].

CONCLUSION

As long as we still face the COVID-19 pandemic, patients with chronic disease who present with

fever and respiratory symptoms should be seen with a high index of suspicion for COVID-19. Imaging plays a significant role in the diagnosis. CO-RADS is a structured and fast reporting system

and provides very good performance for predicting COVID-19 infection in patients with moderate to severe symptoms.

REFERENCES

- [1] W. J. Wiersinga, A. Rhodes, A. C. Cheng, S. J. Peacock, and H. C. Prescott, "Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19) A Review," vol. 2019, pp. 1–13, 2020, doi: 10.1001/jama.2020.12839.
- [2] "covid-19 situation update for the WHO African region, 23 september 2020," 2020.
- [3] J. Nacheha, M. Seydi, and A. Zumla, "The Late Arrival of Coronavirus Disease 2019 (COVID-19) in Africa : Mitigating Pan-continental Spread," vol. 2019, no. 15, pp. 875–878, 2020, doi: 10.1093/cid/ciaa353.
- [4] A. Kerpel, S. Apter, E. Konen, and E. M. Marom, "Diagnostic and Prognostic Value of Chest Radiographs for COVID-19 at Presentation," vol. 21, no. September, pp. 1067–1075, 2020, doi: 10.5811/westjem.2020.7.48842.
- [5] M. V. Revzin et al., "Multisystem imaging manifestations of covid-19, part 1: Viral pathogenesis and pulmonary and vascular system complications," *Radiographics*, vol. 40, no. 6, pp. 1574–1599, 2020, doi: 10.1148/rg.2020200149.
- [6] E. A. Akl et al., "Use of Chest Imaging in the Diagnosis and Management of COVID-19: A WHO Rapid Advice Guide," *Radiology*, p. 203173, 2020, doi: 10.1148/radiol.2020203173.
- [7] J. P. Kanne, B. P. Little, J. H. Chung, B. M. Elicker, and L. H. Ketai, "Essentials for radiologists on COVID-19: An update-radiology scientific expert panel," *Radiology*, vol. 296, no. 2, pp. E113–E114, 2020, doi: 10.1148/radiol.2020200527.
- [8] M. Prokop et al., "CO-RADS-A categorical CT assessment scheme for patients with suspected COVID-19: definition and evaluation Original research," *Radiology*, vol. Published, no. 1, 2020.
- [9] G. Pascarella et al., "COVID-19 diagnosis and management : a comprehensive review," no. March, pp. 1–15, 2020, doi: 10.1111/joim.13091.
- [10] O. Paper, G. Lippi, A. Simundic, and M. Plebani, "Potential preanalytical and analytical vulnerabilities in the laboratory diagnosis of coronavirus disease 2019 (COVID-19)," 2020.
- [11] H. Hou et al., "Pr es s In Pr," vol. 2019, 2019.
- [12] C. Huang et al., "Articles Clinical features of patients infected with 2019 novel coronavirus in Wuhan , China," pp. 497–506, 2020, doi: 10.1016/S0140-6736(20)30183-5.
- [13] X. Ma et al., "A Novel Coronavirus from Patients with Pneumonia in China, 2019," pp. 727–733, 2020, doi: 10.1056/NEJMoa2001017.
- [14] C. Immunosuppression, K. M. Johnson, J. J. Belfer, G. R. Peterson, M. R. Boelkins, and L. E. Dumkow, "R EVIEWS OF T HERAPEUTICS Managing COVID-19 in Renal Transplant Recipients : A Review of Recent Literature and Case Supporting," 2020, doi: 10.1002/phar.2410.
- [15] G. Buszewicz, "COVID-19 : Specific and Non-Specific Clinical Manifestations and Symptoms : The Current State of Knowledge," vol. 2019, no. December 2019, pp. 1–22, 2020.
- [16] H. Shi et al., "Articles Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan , China : a descriptive study," *Lancet Infect. Dis.*, vol. 20, no. 4, pp. 425–434, 2020, doi: 10.1016/S1473-3099(20)30086-4.