Case report

Crit Care Shock (2020) 23:148-153

The use of COVID-19 IgM rapid test in the setting of negative RT-PCR to diagnose infection by SARS-CoV-2: A challenging case

Elizabeth Gamboa, Melanie Duran, Alan Araiza, Daryelle Varon, Mariya Mohiuddin, Joseph C Gathe Jr, Joseph Varon

Abstract

In December 2019, a novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused an outbreak of respiratory disease in Wuhan, China, that quickly spread to other countries causing a global pandemic. Although the reverse transcriptase polymerase chain reaction (RT-PCR) test for SARS-CoV-2 infection has become the standard method of diagnosis, this test has limitations that cause false negative results. The sudden onset, and spread of this virus, has created an urgency to find reliable screening and diagnostic tools to identify infected patients, prevent further transmission, and provide treatment for these patients. A rapid and accurate diagnostic tool, the COVID-19 combined IgG and IgM "Rapid" test can detect these antibodies against SARS-CoV-2 using a finger prick blood sample detecting infection in 15 minutes. We report the use of the COVID-19 IgM Rapid Test in the presence of high clinical suspicion, along with typical chest computed tomography findings suggestive of COVID-19 infection, in a patient who tested negative twice for the nasopharyngeal swab specimen RT-PCR test.

Key words: Coronavirus disease 2019, COVID-19, COVID IgM-IgG rapid test, reverse transcription polymerase chain reaction (RT-PCR), SARS-CoV-2.

Introduction

Coronaviruses are a known pathogens found in many species, including, but not limited to bats, dogs, pigs, whales, humans, and other mammals. (1) In 2003, a severe acute respiratory syndrome (SARS) outbreak emerged in China from a previously unidentified coronavirus of zoonotic origin, SARS-CoV. (2,3) In 2012, MERS-CoV, was responsible for the severe respiratory disease outbreak in the Middle East. (4) In December 2019, various cases of rapidly spreading respiratory infections of unknown origin in Wuhan, China were reported, and the World Health Organization (WHO) was notified. (5) An investigation was conducted obtaining isolation of the 2019 novel coronavirus (2019-nCoV), through bronchoalveolar-lavage samples from patients with pneumonia. The virus was officially named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) because it is genetically very similar to the SARS-CoV, showing more than an 85% identity match. (6)

The WHO named the condition the Coronavirus Disease discovered in 2019 (COVID-19), which is caused by SARS-CoV-2. (7) With the unrelenting increase in the number of deaths and affected countries over the span of just a few weeks, the WHO declared this rapidly spreading COVID-19, a global pandemic on March 11, 2020. (8) We present a case of this challenging infectious disease and the various diagnostic tools that can be considered when there is high clinical suspicion of COVID-19.

From United Memorial Medical Center, Houston, Texas, USA, Universidad Xochicalco, Ensenada, México (Elizabeth Gamboa, Melanie Duran), United Memorial Medical Center, Houston, Texas, USA, Universidad Autónoma de Baja California, Tijuana, México (Alan Araiza), United Memorial Medical Center, Houston, Texas, USA (Daryelle Varon, Mariya Mohiuddin, Joseph C Gathe Jr, Joseph Varon).

Address for correspondence:
Joseph Varon, MD, FACP, FCCP, FCCM, FRSM
2219 Dorrington Street
Houston, Texas 77030, USA
Tel: +1-713-669-1670
Fax: +1-713-669-1671 FAX
Email: jvaron@roamer.net

Case report

A 39-year-old African-American gentleman was admitted after being screened and tested in a COVID-19 drive-thru testing site with a 7-day history of shortness of breath, non-productive cough, chills, nausea, and epigastric pain. He was a trainer at a local gym, which had closed 2 weeks before and also attended a barbecue cook off with thousands in attendance about 7 days prior. The patient denied recent travel history. He had no significant past medical history and denied any history of smoking. On admission, his temperature was 39 °C. Pulmonary auscultation was normal. Leukocyte count $5.7x10^3$/ul, d-Dimer 3.78 mg/l, C-reactive protein 92.23 mg/dl, interleukin-6 (IL-6) 46.6 pg/ml, and procalcitonin level was normal.

Chest computed tomography (CT) revealed bilateral ground glass opacities with predominant involvement in the right lower lobe (**Figures 1-3**). Although results of the nasopharyngeal swab were pending, the classic imaging findings prompted immediate admission to an isolation ward in the hospital. During his first 3 days in the hospital, the patient continued with shortness of breath and a persistent fever fluctuating between 38.5 °C and 40 °C. Due to high clinical suspicion for COVID-19, while awaiting reverse transcription polymerase chain reaction (RT-PCR) result back, we began treatment with hydroxychloroquine, intravenous ascorbic acid, zinc, thiamine, melatonin, and azithromycin. Both the first and the second RT-PCR results were negative. Given the characteristic symptoms and CT scan findings, false-negative results were considered. On day 5, a BioMedomics® (Morrisville, NC) rapid IgM antibody test for COVID-19 was performed and showed a positive result for the coronavirus IgM antibody. On the sixth hospital day, after remaining afebrile and showing significant clinical improvement for three days, the patient was discharged. On follow-up of 3 weeks after discharged he was much improved. His wife and two children remained asymptomatic.

Discussion

The Center for Disease Control and Prevention (CDC) guidelines, recommends real time RT-PCR for detection of SARS-CoV-2 nucleic acid obtained from upper and lower respiratory specimens. (9) Some guidelines consider the RT-PCR to be the gold standard of diagnosis. (10) However, this test has limitations, such as long turnaround times, logistics of testing, and many false negatives. Therefore, negative results should not be the decision point in the course of treatment and management of these patients. (9,10) If the initial swab specimen is negative, a false-negative result should be considered in the presence of recent exposure, clinical signs and symptoms, and CT findings that are all consistent with COVID-19 pulmonary infection. (10-13)

Chest CT has become a diagnostic tool for COVID-19 pneumonia with a very high sensitivity. (10,13,14) Our patient's chest CT findings demonstrated the characteristic peripheral distribution of ground glass opacifications, bilateral involvement with predominance in the lower lobe with a posterior distribution, and the more common involvement of the right lower lobe than the left. (10,12,13,15-18)

In the presence of previous exposure, a clinical picture and characteristic chest CT findings that are consistent with SARS-CoV-2 infection, a false-negative RT-PCR should be considered. In these circumstances, there is an urgent need for a rapid and accurate diagnostic tool, such as a COVID-19 IgM rapid test. In studies performed on PCR positive COVID-19 patients, the overall specificity of this test was 90.63%, and the sensitivity was 88.66%. (19,20)

Conclusion

Our case demonstrates the importance of clinical assessment and radiological findings. While the patient had classic signs and symptoms, initial tests did not reveal a positive test result. A CT scan however, did display common radiological findings that allowed us to confirm COVID-19 and begin treatment. In addition, IgM testing further confirmed our initial diagnosis.

Disclosure

The authors declare no conflicts of interest in the writing of this manuscript.

Figures 1-3. Chest CT obtained on hospital admission shows bilateral ground glass opacities seen predominantly in the right lower lobe

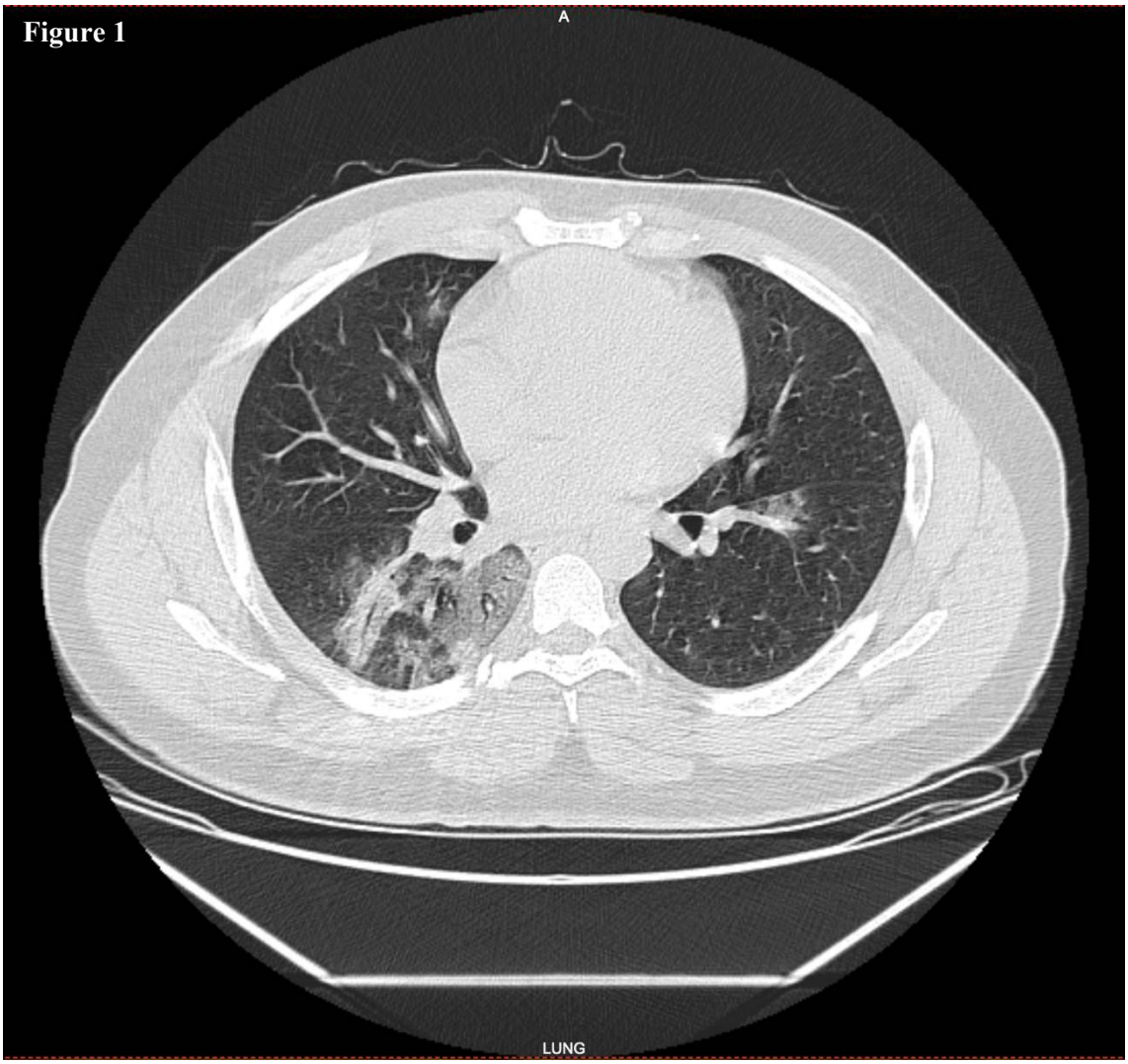


Figure 2

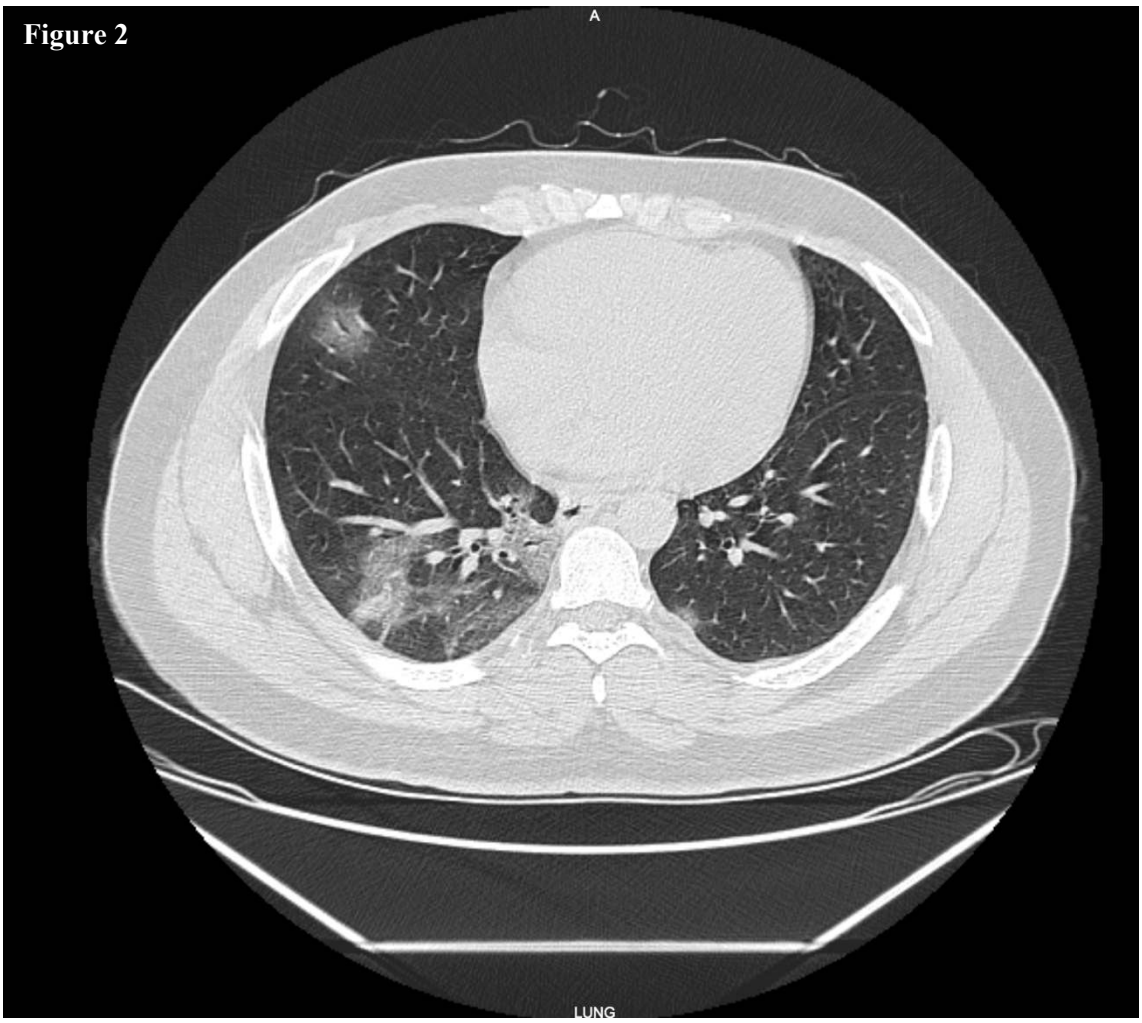
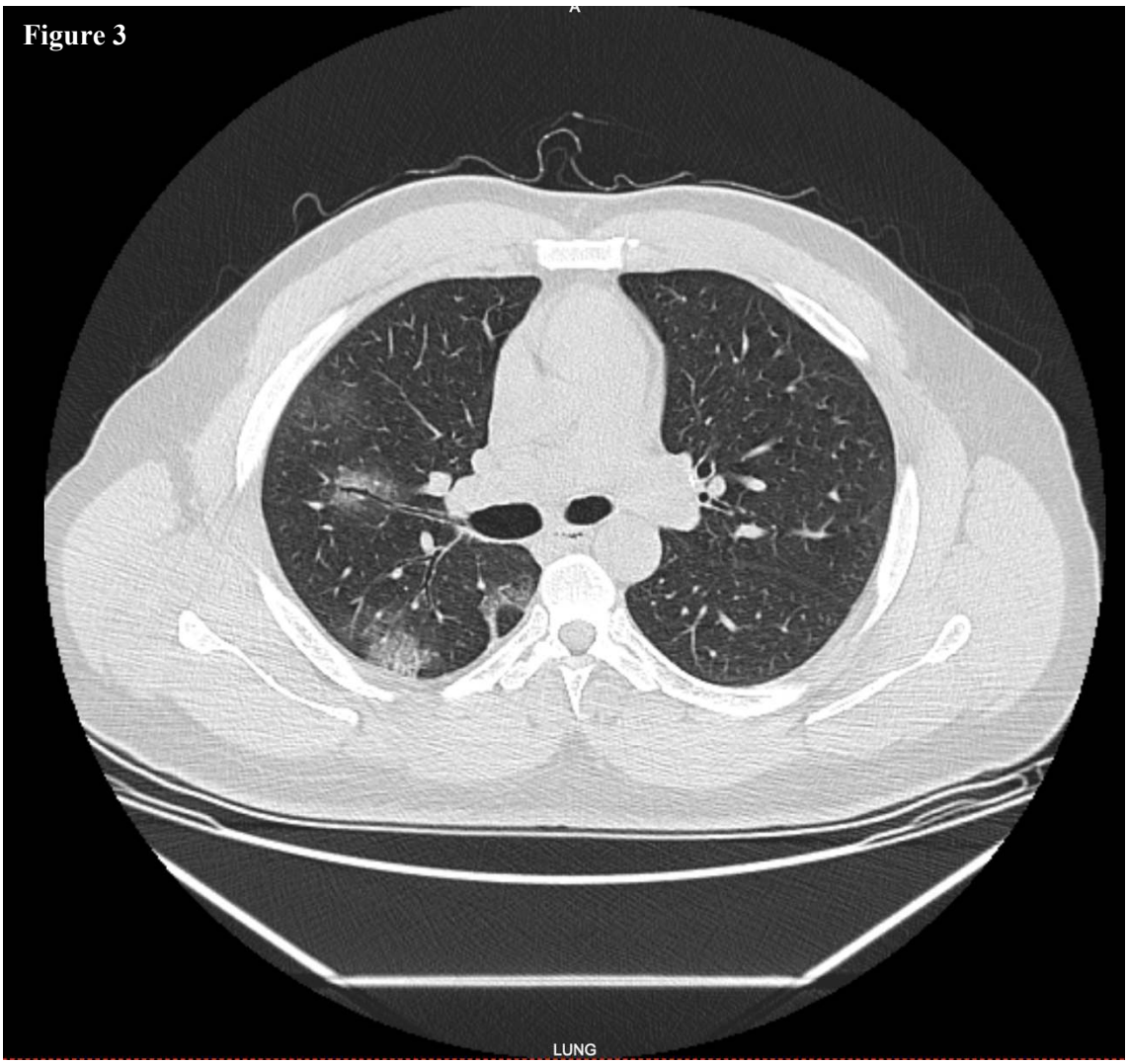


Figure 3



References

1. King A, Lefkowitz EJ, Adams MJ, Carstens EB, editors. Virus taxonomy. Ninth Report of the International Committee on Taxonomy of Viruses. Elsevier; 2011.
2. Zhong NS, Zheng BJ, Li YM, Poon, Xie ZH, Chan KH, et al. Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People's Republic of China, in February, 2003. Lancet 2003;362:1353-8.
3. Ksiazek TG, Erdman D, Goldsmith CS, Zaki SR, Peret T, Emery S, et al. A Novel Coronavirus Associated with Severe Acute Respiratory Syndrome. N Engl J Med 2003;348:1953-66.
4. Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. N Engl J Med. 2012;367: 1814-20.
5. World Health Organization. Pneumonia of unknown cause - China [Internet). 2020 Jan 5 [cited 2020 Apr 11). Available from: https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/
6. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med 2020;382:727-33.
7. World Health Organization. Naming the coronavirus disease (COVID-19) and the virus that causes it [Internet]. [Cited 2020 Apr 11]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it
8. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 [Internet]. 2020 Mar 11 [cited 2020 Apr 11]. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020
9. Centers for Disease Control and Prevention. CDC 2019-Novel Coronavirus (2019-nCoV) Real-Time RT-PCR Diagnostic Panel [Internet]. 2020 Mar 30 [cited 2020 Apr 11]. Available from: https://www.fda.gov/media/134922/download
10. Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology 2020:200642.
11. Huang P, Liu T, Huang L, Liu H, Lei M, Xu W, et al. Use of Chest CT in Combination with Negative RT-PCR Assay for the 2019 Novel Coronavirus but High Clinical Suspicion. Radiology 2020:295:22-3.
12. Salehi S, Abedi A, Balakrishnan S, Gholamrezanezhad A. Coronavirus Disease 2019 (COVID-19): A Systematic Review of Imaging Findings in 919 Patients. AJR Am J Roentgenol 2020;1-7.
13. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for Typical 2019-nCoV Pneumonia: Relationship to Negative RT-PCR Testing. Radiology 2020;200343.
14. Shi H, Han X, Cao Y, Alwalid O, Zheng C. CT screening for early diagnosis of SARS-CoV-2 infection - Authors' reply. Lancet Infect Dis 2020;S1473-3099(20)30247-4.
15. Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, et al. CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV). Radiology 2020;295:202-7.
16. Lei J, Li J, Li X, Qi X. CT Imaging of the 2019 Novel Coronavirus (2019-nCoV) Pneumonia. Radiology 2020;295:18.
17. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497-506.
18. Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020;395:514-23.
19. Nguyen T, Duong Bang D, Wolff A. 2019 Novel Coronavirus Disease (COVID-19): Paving the Road for Rapid Detection and Point-of-Care Diagnostics. Micromachines (Basel) 2020;11:306.
20. Li Z, Yi Y, Luo X, Xiong N, Liu Y, Li S, et al. Development and Clinical Application of A Rapid IgM-IgG Combined Antibody Test for SARS-CoV-2 Infection Diagnosis. J Med Virol 2020. Epub, published ahead of print.