

SARS-CoV-2 and Bacterial Co-Infection

Rodrigo Cavallazzi¹, MD

¹Division of Pulmonary, Critical Care Medicine, and Sleep Disorders, University of Louisville, Louisville, KY, USA

*rodrigo.cavallazzi@louisville.edu

In this issue of the *Journal of Respiratory Infections*, Moore et al report an interesting case of a patient who presented to the hospital with a prostate abscess and urinary tract infection due to *Escherichia coli*. [1] On day 4 of hospital admission, the patient developed acute respiratory failure, became critically ill, and was tested for SARS-CoV-2. Four days later, the result of the polymerase chain reaction test for SARS-CoV-2 became available and was positive. This case highlights dilemmas that the clinician taking care of hospitalized patients with COVID-19 is likely to encounter.

First, was SARS-CoV-2 responsible for the acute deterioration or was it a bystander? It is now well reported that COVID-19 can be asymptomatic or mildly symptomatic in the majority of the patients. In a series of 72,314 cases of COVID-19, 81% had mild disease. [2] Thus, it is conceivable that patients may present with symptoms unrelated to COVID-19 and test positive for SARS-CoV-2. In this particular case, as pointed out by the authors, the acute deterioration after a few days of stability highly suggests that COVID-19 caused the late clinical manifestations.

Second, was SARS-CoV-2 acquired in the community or in the hospital? SARS-CoV-2 is a highly contagious virus and nosocomial transmission of the virus has been reported. But the median incubation period of SARS-CoV-2 is approximately 4 to 5 days, [3] and only 2.5% of infected patients develop symptoms within 2.2 days. [4] Thus, it is more likely that the patient acquired the infection in the community as pointed out by the authors.

Third, should this patient have been tested for COVID-19 upon admission? The immediate institution of patient isolation and full personal protective equipment use along with SARS-CoV-2 testing would likely have minimized exposure to health care professionals and potentially other patients. This patient, however, presented with a clinical picture that was highly suggestive of urine tract infection. Currently, the Centers for Disease Control and Prevention make a high priority the testing of hospitalized patients with one of the following symptoms: 1) subjective fever or temperature > 100°F, 2) cough, 3) shortness of breath, or 4) sore throat. Other symptoms, such as chills or loss of sense of smell, should prompt testing based on clinical suspicion. [5] But the symptom-based strategy for testing of hospitalized patients could potentially lead to a number of undiagnosed patients because clinicians may fail to apply the testing algorithm or because some patients with COVID-19 may not have the above symptoms. Another strategy that is being applied by some hospitals is the universal testing for SARS-CoV-2 upon admission of all hospitalized patients. This approach is currently in place at University of Louisville Hospital.

Fourth, could SARS-CoV-2 have predisposed this patient to superimposed bacterial infection? The interaction between virus and bacterium has been well documented with influenza infection. Postmortem sample analysis of patients who acquired influenza during the 1918 pandemic revealed that secondary bacterial infection caused most influenza-related deaths. The cytopathic effect of the virus to the bronchial and alveolar epithelium leads to sloughing of epithelial cells, hyaline membrane formation, and eventual denuded bronchial epithelium. These effects predispose to superimposed bacterial infection. [6] Based on the clinical data available so far, it appears that bacterial co-in-

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fection may not be as pronounced in the setting of SARS-CoV-2. In one review, 8% of the patients with COVID-19 had bacterial or fungal co-infection. [7] However, we are just now starting to accumulate clinical data on COVID-19. As more data become available, it is possible that our understanding of the role of co-infection in SARS-CoV-2 will change. If SARS-CoV-2 does predispose to bacterial co-infection, it is reasonable to expect that the natural portal of entry of bacterium would be the respiratory tract rather than the urinary tract.

In summary, this case has a number of teaching points and highlights the importance of viral/bacterial co-infection. Clearly, there is a need for additional case series with a more detailed description of bacterial infections in the setting of COVID-19. Postmortem and histopathologic studies are also likely to further clarify the role of bacterial co-infection in these patients.

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