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## Anaphylactic shock following the diagnosis of coronavirus disease 2019



Anaphylaxis is an acute, life-threatening systemic allergic reaction that may have a wide range of clinical manifestations.<sup>1</sup> Some of those signs and symptoms are similar to those that happen during the acute respiratory distress caused by the novel coronavirus disease 2019 (COVID-19).<sup>2</sup>

A 74-year-old woman with a history of hypertension and bronchial asthma presented to the emergency department (ED) with a 3-day history of malaise, subjective fever, dry cough, and diarrhea. On admission, her temperature was 36.9°C with a pulse rate of 99 bpm, blood pressure of 127/83 mm Hg, and oxygen saturation of 93% on ambient air. Laboratory test results indicated mild lymphopenia (lymphocyte count of  $1.0 \times 10^9/L$ ), and the C-reactive protein level was elevated at 55 mg/L. Chest radiography showed no consolidations. COVID-19 was diagnosed based on reverse transcription–polymerase chain reaction test results, which detected severe acute respiratory syndrome coronavirus 2. Per the hospital's COVID-19 protocol, the patient was discharged with instructions for isolation and a dose of cefixime 400 mg daily as an empirical antibiotic to prevent potential superinfection. She had tolerated other  $\beta$ -lactams in the past (penicillin, amoxicillin), but did not recall taking cephalosporins.

A few hours later, the patient presented to the ED again because of a sudden onset of dyspnea. On examination, the blood pressure was 90/55 mm Hg, pulse rate was 119 bpm, and oxygen saturation was 80%. She also had hives, erythema, systemic pruritus, and a swollen tongue. The episode started 20 minutes after she took the first dose of cefixime and progressed from the initial mild pruritus of her palms and soles. Laboratory test results indicated moderate lymphopenia ( $0.4 \times 10^9/L$ ) and elevated D-dimer (12.8 mg/L). Because of high D-dimer levels, the patient underwent a pulmonary angiogram, which turned out normal, ruling out pulmonary embolism.

She received methylprednisolone, dexchlorpheniramine, inhaled salbutamol and oxygen, and experienced full recovery in 2 hours, with an improvement of vital signs, including blood pressure (127/76 mm Hg) and oxygen saturation (97%). An electrocardiogram showed normal rhythm at a rate of 64. Yet, a cytokine release syndrome was suspected, and the patient was admitted to the COVID-19 unit and started treatment with hydroxychloroquine, lopinavir and ritonavir. However, other markers were at normal levels (ferritin 199  $\mu g/L$ ), and D-dimer levels decreased to 2.7 mg/L in 12 hours, rapidly reaching normal levels in 2 days (Fig 1). The baseline serum tryptase levels on arrival at the ED were elevated (65.8  $\mu g/L$ ), but after 10 days, the levels decreased to within the reference range (4.18  $\mu g/L$ ).

The patient remained in stable condition until day 12 when she suddenly worsened with the reappearance of fever and hypoxemia. Chest radiography showed left middle-lobe pneumonia; thus, treatment with methylprednisolone was started. She was admitted to the intensive care unit on day 13. Coinciding with this deterioration, her D-dimer levels increased up to 1.2 mg/L (Fig 1), and so

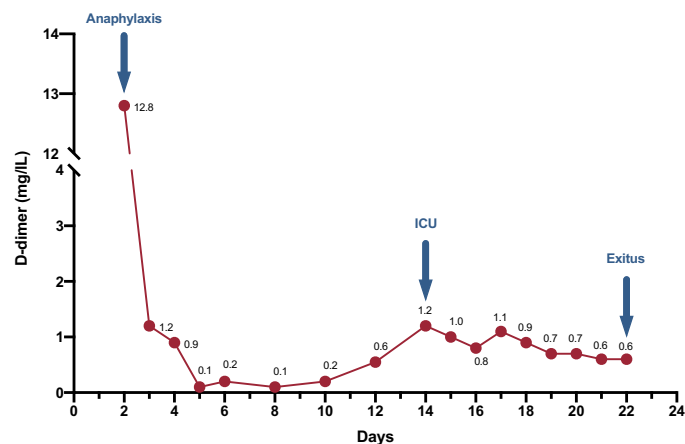


Figure 1. Evolution of D-dimer levels. ICU, intensive care unit.

did other inflammatory markers (ferritin, 2186  $\mu g/L$ ). Despite intubation, anticoagulation, and vasoactive drug therapy, the patient died after 9 days.

This case indicates how anaphylaxis may mimic symptoms caused by SARS-CoV-2. Cytokine release syndrome has been described in patients with COVID-19, which present with sudden-onset dyspnea, hypoxemia, and increased D-dimer levels<sup>2</sup>; a variety of skin lesions have also been reported,<sup>3</sup> including urticaria.<sup>4</sup> However, these signs and symptoms may also be present in patients with anaphylaxis, including elevated D-dimer levels.<sup>5</sup> Therefore, the differential diagnosis between these 2 conditions can be challenging. In this patient, the presence of typical anaphylaxis symptoms (itching of palms and soles) and its acute development after exposure to a likely allergen, and also an elevated serum tryptase were key in the diagnosis of anaphylaxis.<sup>1</sup> Curiously, she had much higher D-dimer levels during anaphylaxis than when she suffered more severe signs from COVID-19. Although there has been no experience with COVID-19, other viral infections are known to act as cofactors, increasing the severity of anaphylaxis.<sup>6</sup> This might have contributed to the severity of anaphylaxis in this particular case. Finally, cefixime allergy could not be confirmed owing to the fatal outcome. However, the temporal sequence strongly suggests that cefixime was the trigger of the anaphylaxis.<sup>7</sup>

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# Patient satisfaction with telemedicine encounters in an allergy and immunology practice during the coronavirus disease 2019 pandemic



The use of telemedicine dates as far back as 50 years ago, when the University of Nebraska used interactive telemedicine to transmit neurologic examinations.<sup>1</sup> Since that time, despite advances in available technologies and proven utility of telemedicine in allergy and immunology (AI),<sup>2,3</sup> the use of telemedicine by AI physicians remains low.<sup>4</sup> With the global spread of the novel coronavirus disease 2019 (COVID-19), AI physicians were abruptly forced to change their mode of health care delivery. Given the need for social distancing and exposure mitigation, many practices quickly adapted to remote encounters from primarily in-person care.<sup>5</sup> Because it has become clear that the COVID-19 pandemic will have long-lasting consequences, the emergence of telemedicine presents an opportunity for optimizing health care delivery in our specialty. Given the paucity of data on patient satisfaction with telemedicine, we aimed to further characterize this understudied area.

We prospectively collected patient encounter data for the 4-week period from April 13, 2020 to May 08, 2020, among 4 physicians at the Rochester Regional Health AI practice, Rochester, New York. The appointment type (in person, telephone, or telemedicine) was tracked for all encounters, but only telemedicine encounters were studied further. Telemedicine encounters were completed using the following third-party vendors: Epic Warp (Epic Systems Corp, Verona, Wisconsin); Skype (Skype Communications, Palo Alto, California); FaceTime (Apple Inc, Cupertino, California); and Doximity (Doximity, San Francisco, California), depending on the patient preference. For telemedicine encounters, the following were collected: number of new patient (NP) encounters, number of follow-up (FU) encounters, patient sex, patient age, primary diagnosis, biologic therapy or immunotherapy, and encounter completeness as determined by the treating physician. Patients evaluated by telemedicine were contacted by telephone within 7 days to answer 3 patient satisfaction questions (Table 1). Statistical analysis was performed using Stata software (StataCorp LLC, College Station, Texas). Fischer's exact test was used to compare the frequencies of the baseline variables vs low and high patient satisfaction scores.

A total of 518 encounters occurred during the study period. Of these, 34 (6.6%) were in person, 194 (37.5%) were by means of telephone, and 290 (56.4%) were conducted with telemedicine. Of the 290 telemedicine encounters, 110 patients (37.9%) could not be

reached to complete the FU satisfaction questions, 3 (1.0%) declined to answer, and 177 (61.0%) completed the satisfaction questions. Of the 177 encounters of patients who completed the satisfaction questions, 72 (40.6%) were NP evaluations, and 105 (59.3%) were FU evaluations, with 115 (64.9%) of female patients. The median age of the cohort was 33 years (interquartile range, 9–55 years). The primary diagnoses were as follows: chronic rhinitis and sinusitis, 48 (27.1%); asthma, 33 (18.6%); food allergy, 32 (18.0%); urticaria, 14 (7.9%); immunodeficiency, 7 (3.9%); and drug allergy, 6 (3.4%). Notably, 37 patients (20.9%) received other diagnoses and 40 patients (22.6%) were receiving immunotherapy or therapy with a biologic. The treating physician deemed 102 evaluations (57.6%) to be complete, whereas 75 (42.4%) were deemed incomplete.

Responses to the patient satisfaction questions are given in Table 1. Nearly 97% of patients were satisfied with their telemedicine encounter, and 77.4% believed it was as satisfactory as an in-person encounter. When asked the most important reason to prefer an in-person evaluation, 95 of 177 (53.7%) patients offered a reason. The desire for a more personal interaction was the most frequently cited reason by 45.3% of patients. No significant associations were found between the following patient satisfaction scores and baseline variables: NP vs FU ( $P = .38$ ), sex ( $P = .67$ ), age ( $P = .65$ ), primary diagnosis ( $P = .47$ ), treatment with immunotherapy or biologics ( $P = .62$ ), and whether the physician deemed the evaluation to be complete ( $P = .24$ ).

The COVID-19 pandemic has facilitated widespread adoption of telemedicine in AI practices. Despite the sudden change in the mode of health care delivery, our results indicate that patients have been highly satisfied with these encounters. Nearly 97% agreed or strongly agreed that they were satisfied with their telemedicine encounter. These rates mirror similar work by Staicu et al<sup>3</sup> and Waibel et al<sup>6</sup> who found that 98% of patients were satisfied with a telemedicine evaluation. In addition, in our study, most patients thought that their telemedicine encounter was as satisfactory as an in-person encounter, whereas only 12.8% of patients disagreed with this sentiment. Although telemedicine has currently been necessary for social distancing to mitigate the risk of exposure to COVID-19, we hypothesize that going forward patients may continue to favorably view telemedicine because of its potential to save time and improve access to specialty care. These benefits must be weighed against the advantages of an in-person evaluation, including the sense of a more personable interaction, the ability to perform a physical examination, and the ability to order routine diagnostic testing.

Our data indicate that patients report high satisfaction with telemedicine regardless of their primary diagnoses and types of evaluations (NP vs FU). Although nearly half of the encounters were deemed to be incomplete by the treating physician, these

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