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## **CLINICAL CORRESPONDENCE**

### **Foot Manifestations in a COVID-19 Positive Patient A Case Study**

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At the time of this writing, the SARS-CoV-2 (COVID-19) has infected over three million people throughout the world with more than 200,000 deaths. [1] Observations, case studies and some case series suggest COVID-19 can affect the feet or lower limb [2-9].

Due to the limited availability of tests for COVID-19, a significant number of the cases in the literature are not tested for COVID-19. As a result, the diagnosis of COVID-19 has often been based on the patient's history and the physician's clinical judgment. For example, the case series of Fernandez-Nieto et al. considered cutaneous manifestations on patients who had close contact with a confirmed COVID-19 patient (54 patients), were in close contact with a health

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worker (28 patients) or were clinically diagnosed to have COVID-19 (19 patients). Eleven patients were tested for COVID-19, and two patients tested positive. Similarly, Landa et al. considered the patients' symptoms and whether there was close contact with a person who tested positive for COVID-19. Out of six patients, two were COVID-19-positive.

Piccolo et al. had a series of 63 patients with six testing positive for COVID-19. The series showed that feet alone were affected most frequently (85.7%), followed by feet and hands together (7%).

Skin manifestations have been the focus of these reports, which have been described as presenting as rashes: petechial, erythematous, chilblains, and ischemic. Recalcati collected data from 88 hospitalized COVID-19 positive patients in Italy. Cutaneous manifestations occurred in 18 patients, with the trunk cited as the primary involved area. [10] A study from Wuhan China of seven critical COVID-19 adult patients documented limb ischemia and gangrene in the feet and hands, which accounted for 21% of critically ill patients hospitalized at the same time. [11] The authors could find no additional publications documenting the possible connection of foot issues with COVID-19 or any reports describing an effect on a patient's gait.

A letter by Basatneh and Vlahovic to the Journal of the American Podiatric Medical Association explained that the discussion in the U.S. about COVID-19 manifesting in the feet finds its origins in a slideshow by Maria del Mar Ruiz Herrera<sup>1</sup>, a podiatrist in Spain. The presentation was subsequently translated to English by a U.S. podiatrist and posted online. [12,

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<sup>1</sup> Dr. María del Mar Ruiz Herrera is one of the authors of this article.

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13] Public media outlets refer to possible manifestations of COVID-19 in the feet as “COVID toes.” [14]

Basatneh and Vlahovic reported that Dr. del Mar Ruiz Herrera’s slideshow provided little clinical information, noting the presentation did not explain if constitutional symptoms were present, or if testing was done for COVID-19. This report presents more details with respect to one of the cases presented in the slideshow and the follow-up with that particular patient.

By way of background, the first confirmed case of COVID-19 in Spain was reported on January 31, 2020. On March 14, the country declared a state of emergency and restricted the movement of its citizens. [15] On April 27, Spain reported a total of 229,422 COVID-19 cases and 23,521 deaths, ranking the country second in the world, surpassed only by the United States. [16]

### **Case Study**

On March 30, 2020, a 16-year-old female in the city of Ciudad Real, confined to her home for two weeks, developed foot problems. There was no history of trauma, and her feet had not been exposed to extreme temperatures or other adverse conditions. She had no health issues, no allergies, no history of foot or dermatologic problems, did not smoke or vape, and was not taking any medication or using any over-the-counter medications.

Prior to her two weeks of confinement, a relative was confirmed to have contracted COVID-19, but the patient did not recall exposure to that individual. In the beginning of April, the patient noticed red-violet lesions appearing on her feet. She experienced itching, mild

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swelling of both feet, and severe pain, which she described as “burning.” The patient stated that the pain woke her up at night, and that walking exacerbated the pain to the point that she limped and finally was unable to walk. A few days later, along with her mother and her sister, the patient experienced fever, nausea, dizziness, stomach upset, cough, chest tightness, and headaches.

The 16-year-old initially was seen by her family physician by telemedicine who advised her to take acetaminophen and apply a topical over-the-counter cream, Mahiou, which contains Omega 3 and 6 in a base of lanolin and glycerin and is recommended as a treatment for chilblains. The cream eased her foot pain.

On April 10, the patient consulted Dr. del Mar Ruiz Herrera via telemedicine for her foot issues (Fig 1). Dr. del Mar Ruiz Herrera advised the patient to go to the hospital for treatment and testing for COVID-19. However, the family physician contradicted this direction and told the patient not to go to the hospital, reasoning that the problems were not of a severity to warrant hospital treatment. Her physician agreed with the need for testing for COVID-19, but at the time no tests were available in the area. The patient followed her family doctor’s advice and stayed home. Four days later, the pain and itching ceased and she discontinued the cream. The burning disappeared, and the swelling was decreasing, although the redness on her feet persisted. Her gait returned to normal.

However, on April 23, the patient experienced nausea, dizziness, headaches, and dry eyes. Her feet began to worsen with increased redness and mild to moderate pain, along with pain when walking. She did not have a fever or cough at this point, but complained of mild

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shortness of breath, particularly when active. She resumed using the topical cream, which lessened her foot pain. Her other symptoms persisted.

On April 26, testing for COVID-19 became available and she was found to be positive for the disease. As of April 28, the redness persisted (Figs. 2 and 3), but the pain decreased though remained present to a lesser extent. She continues to experience nausea and headache. She is able to walk without significant pain.

## **Discussion**

This case study is one of the first to consider the possible foot manifestations of COVID-19 beyond skin manifestations, particularly including gait alteration. The study closely documents the progression of the disease's manifestations in the feet along with concomitant symptoms of COVID-19. In this case, the patient noted that the pain was so severe in her feet that it woke her at night. More significantly, the pain was aggravated by walking to the extent that her gait exhibited a limp. In fact, the pain brought on by COVID-19 became so intense that she was ultimately unable to walk for a period of time.

Notably, after the patient's foot pain subsided completely by mid-April, it abruptly recurred and worsened on April 24, though the pain never reached the level of severity she experienced in early April. The patient's burning pain may suggest a neuropathic type-mechanism. Indeed, research has recognized the occurrence of peripheral nervous system issues, such as neuralgia. [17]

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Limitations of this case study include a lack of a biopsy, additional lab investigations, and radiographs to discover if bone changes occurred. Also lacking in this study is any type of clinical gait analysis to examine the progression of the changes in the patient's gait and the precise description of the gait alteration.

It is plausible that the patient's foot issues occurred at the time she was positive for COVID-19 by coincidence, and there could be another reason for her pain and associated gait alteration. In general, when considering a patient with similar foot issues, the podiatrist may consider other viral diseases, idiopathic chilblains, chilblains lupus erythematosus, vasculitis, pernio, Aicardi–Goutières syndrome, a connective tissue disorder, underlying osseous abnormalities, or even the effects of recent exposure to cold temperature or the possibility of ill-fitting footwear creating pressure points or sores.

Though the case studies and case series published to date suggest a COVID-19 effect on the feet in some instances, further study may refute this inference. The authors propose analysis of more cases and a diversity of cases to fully understand the effect of COVID-19 on the feet, particularly from a podiatric physician's perspective, including x-rays, biopsy, and gait analysis. A closer examination of patients' gait should be considered in some COVID-19 cases or suspected cases, as for example, Mao et al. reported central nervous system involvement and five patients with ataxia. [18]

Muscle strength testing, a standard of the podiatrist's examination, may provide insight as Toscano et al. reported on lower-limb weakness and paresthesia as the first symptoms of Guillain–Barré Syndrome (GBS) in four out of five COVID-19 patients who developed GBS. [19]

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Peripheral vascular evaluation, another mainstay of the podiatric examination, may reveal issues associated with COVID-19 as it has been linked to coagulopathy and risk of thrombosis, including deep vein thrombosis and peripheral artery embolism. [20]

The effects of COVID-19 on the foot are not clear, and while numerous publications to date have focused on possible cutaneous manifestations of COVID-19 in the feet, other information suggests that the foot may be subject to broader COVID-19 related issues, beyond dermatology. As such, until research yields more answers, podiatrists should remain vigilant to consider the findings of all aspects of their evaluation, including the vascular, musculoskeletal and neurologic systems.

If it is determined that COVID-19 manifests in the feet or toes—podiatrists, physicians, other healthcare workers and even parents and caregivers, must be alert to watch for these problems. Detecting the disease early will allow the patient to potentially begin treatment and limit exposure to others.

## **Conclusions**

COVID-19 is not fully understood at this time, and as such, the medical community must proceed cautiously when drawing conclusions. However, due to the dangerous nature of the disease, time is of the essence. This case represents just one example of foot manifestations and gait alteration that appear to be related to COVID-19. For medical certainty, more cases and research are needed. The authors expect additional studies and research will emerge to

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further understand COVID-19's influence on gait and the disease's vascular, neurologic, musculoskeletal and dermatologic effects on the foot.

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Fig. 1 The patient's feet on April 10, 2020, after the pain began to lessen.



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Fig. 2 The patient's right foot on April 28, 2020.



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Fig. 3 The patient's left foot on April 28, 2020

