

Clinical and Medical Imaging Findings of the Forefoot Following a COVID-19 Infection

A Case Report

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Since the beginning of the SARS-CoV-2 pandemic, manifestations of the COVID-19 virus have been reported throughout the body, visible both clinically and radiographically. In the foot and ankle, one such phenomenon presents as cutaneous changes associated with neuralgia to the digits. Although rare, emerging reports described similar manifestations of COVID-19 in the foot, though limited to superficial structures. In this case report, we present a 52-year-old male experiencing burning pain and hyperpigmented lesions to the digits of his left foot 2 weeks prior to a formal diagnosis with COVID-19. Advanced imaging showed a third interspace neuroma as well as distal-to-proximal bone marrow edema in the distal phalanx of all digits, a pattern seen in vasculopathies, 4 weeks after diagnosis. In the absence of diabetes mellitus or peripheral vascular disease, the patient underwent a simple neurectomy. At the follow-up appointment 12 weeks after the initial encounter, his symptoms resolved. Our study reports a case describing osseous along with cutaneous manifestations in the foot of a patient with COVID-19. (J Am Podiatr Med Assoc 114(4), 2024; doi:10.7547/22-104)

The SARS-CoV-2 pandemic presented challenges in both diagnosing and providing foot and ankle care. Beginning with the onset of the pandemic, there was a disruption in health-care delivery in which missed in-person office visits and follow-up may have compromised patient care.¹ At the same time, cutaneous manifestations of the virus in the lower extremity began to emerge, colloquially recognized as “covid toe.”^{2,3} While the pathophysiology of this Pernio-like phenomenon remains debated, reports continue to emerge.^{4,5} With treatment ranging from conservative topical medication to amputation in advanced vasculitis, identifying all potential clinical presentations in the periphery remains foremost in preventing limb loss.^{2,6} In this study, we present a patient with digital lesions and underlying bone marrow edema following a COVID-19 infection. Differing from previously published encounters, this case report details a prolonged manifestation of the virus in the foot.

Case Report

A 52-year-old male presented to the outpatient clinic with cold, stiff, and burning toes. He stated that the pain began 6 weeks prior to the office encounter. The pain was localized to the digits on his left foot, with no proximal radiation. Since onset, he indicated he thought his toes were contracting and became erythematous, though the redness subsided. He became worried as he noticed spots forming on the bottom of his toes that did not wash off. Since previously treated for a Morton’s neuroma using steroid injections and orthotics to the left foot 2 years prior, the patient reported no issues with his feet otherwise. The patient had a past medical history of anxiety and insomnia. He was diagnosed with COVID-19 4 weeks before presenting to the clinic, with no known prior infection. His past surgical history consisted of a rotator cuff repair and total hip arthroplasty. The patient was fully vaccinated and boosted with the Moderna vaccine. He took alprazolam for his anxiety and no other medications were taken routinely.

The patient presented with no constitutional signs of infection. Upon clinical examination, pedal

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pulses were palpable with immediate capillary refill to the toes. The toes felt cold to the touch. Light touch sensation was grossly intact at the level of the digits using a Semmes-Weinstein monofilament. A Mulder's click was noted at the third interspace. A negative Tinel's and Valleix's sign was assessed at the level of the suspected neuroma or proximal superficial and deep nerves innervating the foot and ankle. A reducible hammertoe deformity was noted to the second through fourth digits. No muscular weakness was noted. A hyperpigmented lesion with surrounding dry skin was noted to the distal pulp of the left first, second, and fourth digit as shown in Figure 1. The lesions were symmetric with well-defined borders and a brown coloration. No variation regarding pain and lesion size or discoloration was noted, with all toes exhibiting comparable symptomatology. Plain radiographs were unremarkable. Due to the history of a neuroma alongside current neuropathic pain to the left foot, magnetic resonance imaging (MRI) was ordered. Advanced imaging revealed a distal-to-proximal migrating marrow edema pattern to all distal phalanges as seen in Figure 2. The presence of a neuroma measuring 7 x 5 mm was noted at the third interspace. At the follow-up appointment, the MRI findings were discussed with the patient, and the treatment agreed upon consisted of close monitoring with follow-up. The patient's pain continued, and he underwent a simple neurectomy without intraoperative steroid injection or application of biologics. The pathology report confirmed the presence of a neuroma. The patient followed-up over a 12-week period during which the



Figure 1. Clinical presentation of the left foot during the initial encounter.

diffuse forefoot neuralgia symptoms improved. Moreover, the lesions on the respective distal tufts resolved as did the previously reported digital cold and stiff phenomenon.

Discussion

With a continued number of daily reported COVID-19 cases adding to the already greater than 500 million cases worldwide, the pandemic continues to progress with society's reopening.⁷ Due to the asymptomatic nature of those afflicted, recognition of atypical symptoms beyond the fever, cough, fatigue, and dyspnea may assist in identifying and preventing further transmission of the virus.⁸ This report highlights one such atypical manifestation of the disease process both weeks before and after a formal diagnosis. In this case, the patient exhibited neuralgia to the digits 2 weeks prior and 4 weeks after testing positive for the virus. Additionally, advanced imaging showed an underlying osseous component in the absence of open wounds or other portal of entry, which has not been previously described.

The erythematous and hyperpigmented cutaneous changes reported in this case are consistent with the wide-range of presentations of COVID-19.⁹ Similarly, the burning sensation experienced is shared with the neuralgia reported by previous cases.^{2,10} Though neuralgia may have been associated with the isolated neuroma, the neurologic distribution in this patient remained diffuse and not isolated to the interspace one would expect the neuroma to affect. Although there are no reports of bone marrow edema secondary to COVID-19 in the foot, conditions exhibiting similar clinical presentations maintained a distinct distal-to-proximal pattern of edema.^{11,12} As these findings were seen in the phalanges of those with Raynaud's and Phalangeal Microgeodic Syndrome, musculoskeletal manifestations of COVID-19 in the foot may share vasospasm as a contributing symptom.

Although bone marrow edema may be secondary to repetitive trauma in the setting of neuropathy, this patient did not have any rigid digital deformities and was completely sensate. Moreover, the patient did not begin any new medications that may result in pigmentation or vascular changes. In the absence of any other contributing factor associated with cutaneous or osseous digital changes at the time of and following the COVID-19 diagnosis, this presentation was likely a sequelae of the disease process. While possible mechanisms for underlying bone

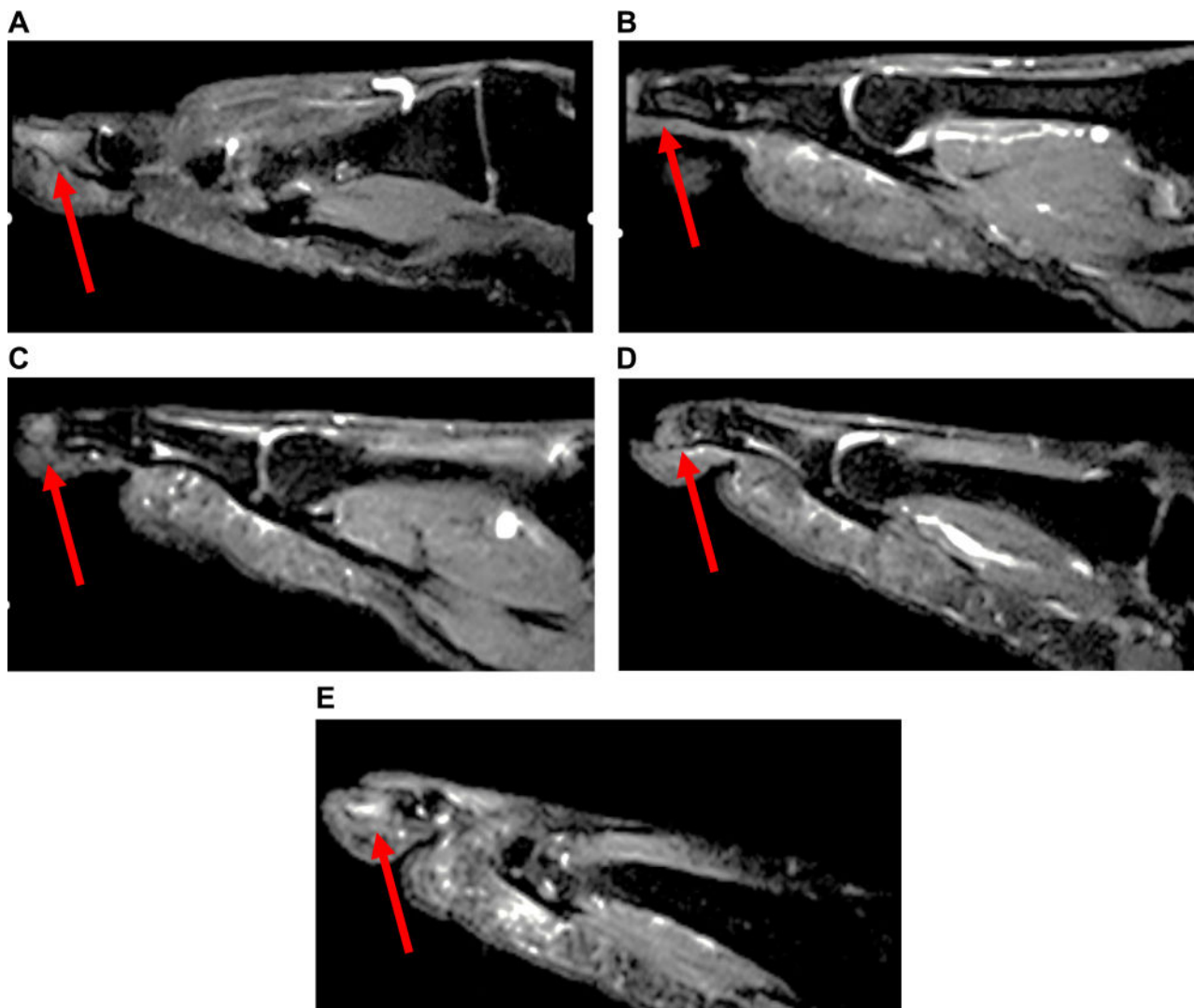


Figure 2. Magnetic resonance imaging showing distal to proximal migration of bone marrow edema in the (A) first, (B), second, (C) third, (D) fourth, and (E) fifth distal phalanges of the left foot.

marrow edema or symptoms are consistent with new-onset arthritis, some possibilities have been introduced. Although no other osseous changes in other bones of the body have been reported following COVID-19 diagnosis, previous case reports pointed to thrombotic and bleeding manifestations as well as vasopressor administration in severe disease as a contributor to extremity marrow edema.¹³⁻¹⁷ Recent reports also pointed to reactive arthritis occurring after COVID-19 infection, though an underlying mechanism was unclear.¹⁸ Similarly, systemic rheumatologic manifestations including inflammatory arthritis, myositis, and vasculitis following COVID-19 infection have been reported.¹⁹

To further examine such causative findings as hypothesized in this and several other investigations,

future reports may further examine the factors limiting the conclusions drawn from this case study. Specific limitations included an absence of a laboratory workup, biopsy, and advanced imaging after recovery to determine if the marrow edema resolved. Moreover, since the timing of the forefoot pathology preceded a positive COVID-19 test by 2 weeks, it can only be assumed that the patient was presymptomatic, as there were no other contributing factors at the time of diagnosis. Future studies would need to test patients for the virus at the onset of the lower-extremity manifestations to better describe the cutaneous or osseous changes in relation to the progression of COVID-19.

In conclusion, although further research is needed to link the systemic nature of the virus to localized

appendageal effects, this case adds another example of the neurovascular, dermatological, and musculoskeletal manifestations to the foot and ankle. As patients present to the clinic in the next phases of the pandemic, appreciating cutaneous and underlying osseous manifestations of the virus are important. In those with multiple comorbidities who exhibited the poorest outcomes after infection, early detection, treatment, or referral may save limbs and ultimately reduce mortality. This proves critical in the patients podiatrists usually treat, especially those with diabetes mellitus and peripheral artery.

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Conflict of Interest: None reported.

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