What Is Causing These Green Nails?

Itohan H. Omorodion, MPH[1] ▪ Jack Lee, MD[2] ▪ Barrett J. Zlotoff, MD[2]

An 81-year-old man was referred to our dermatology clinic with discoloration of the right thumbnail. The nail discoloration had been present for a month and a half and was not associated with pain. He had been applying an antifungal solution to the affected nails with only slight reduction in the size of the streaks and no substantial change in the hue of the pigmentation.

His medical history was significant for idiopathic bronchiectasis associated with a productive cough. He had spent his daily life indoors doing office work for his personal publishing company and did not engage in outdoor hobbies, work with dyes, or do a substantial amount of wet work.

Results of a physical examination were significant for a greenish-black linear streak along the lateral edge of the right thumbnail, uniform in width and extending from the proximal nailfold to the free edge of the nail (Figure 1). A similar linear streak was present on the right index fingernail and was light green in color. He did not have Hutchinson's sign. The color penetrated the full thickness of the affected nails and could not be scraped off. There was also distal onycholysis of the right thumbnail, as well as of the middle fingers bilaterally. The patient's toenails had notable opacification and thickening bilaterally.

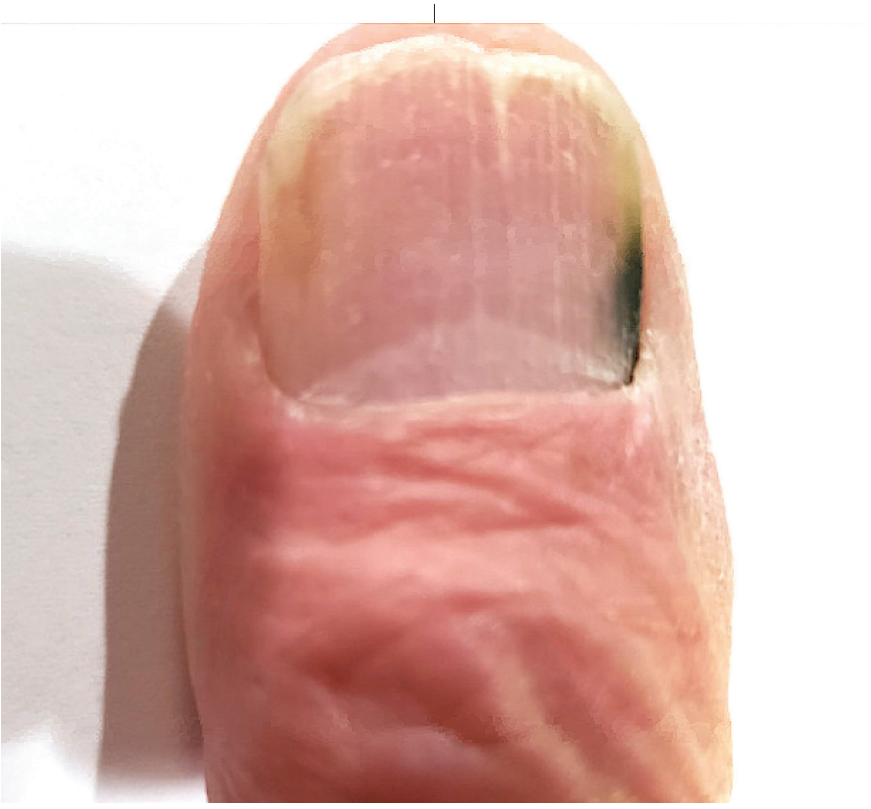

Figure 1. Thumbnail with a greenish-black linear streak extending from the proximal nail fold to the free edge of the nail and distal onycholysis.

Based on this patient's presentation, what is the most likely diagnosis?

A. Subungual hematoma
B. Subungual melanoma
C. Bacterial infection
D. Cyanosis
E. Melanonychia

AFFILIATIONS:
[1]School of Medicine, University of Virginia, Charlottesville, Virginia
[2]Department of Dermatology, University of Virginia, Charlottesville, Virginia

CITATION:
Omorodion IH, Lee J, Zlotoff BJ. What is causing these green nails? *Consultant*. Published online March 16, 2021. doi:10.25270/con.2021.03.00014

Received November 6, 2020. Accepted January 8, 2021.

DISCLOSURES:
The authors report no relevant financial relationships.

CORRESPONDENCE:

Itohan Omorodion, MPH, University of Virginia Department of Dermatology, 1221 Lee Street, Charlottesville, VA 22908 (iho5gp@virginia.edu)

Correct answer: C. Bacterial infection

Histopathological evaluation of the patient's nail clippings from the affected thumbnail revealed the presence of fungal organisms with periodic acid–Schiff stain, as well as focal increases in melanin pigment (Figure 2). A Gram stain was positive for bacteria (gram-positive vs gram-negative cannot be discerned on tissue stains). Bacterial culture of the nail clippings grew Pseudomonas aeruginosa and coagulase-negative staphylococcus species. A chart review revealed that serial sputum samples over the last 8 months prior to his presentation at our clinic had all grown *Staphylococcus aureus* and *P aeruginosa*.

Green nail syndrome (GNS) secondary to pseudomonas, with an incidental finding of onychomycosis, was diagnosed. The focally increased melanin was likely a benign reactive process because of low-grade inflammation from pseudomonas near the nail matrix. Of note, the patient did not have any overt signs or symptoms of nail fold inflammation or paronychia. Suggested treatment included soaking his fingernails in common household white vinegar, diluted to a 4:1 solution with tap water, for 5 minutes daily for a 3-month course. One month into the treatment course, the patient reported no recurrence. The onychomycosis was treated with oral antifungal agents.

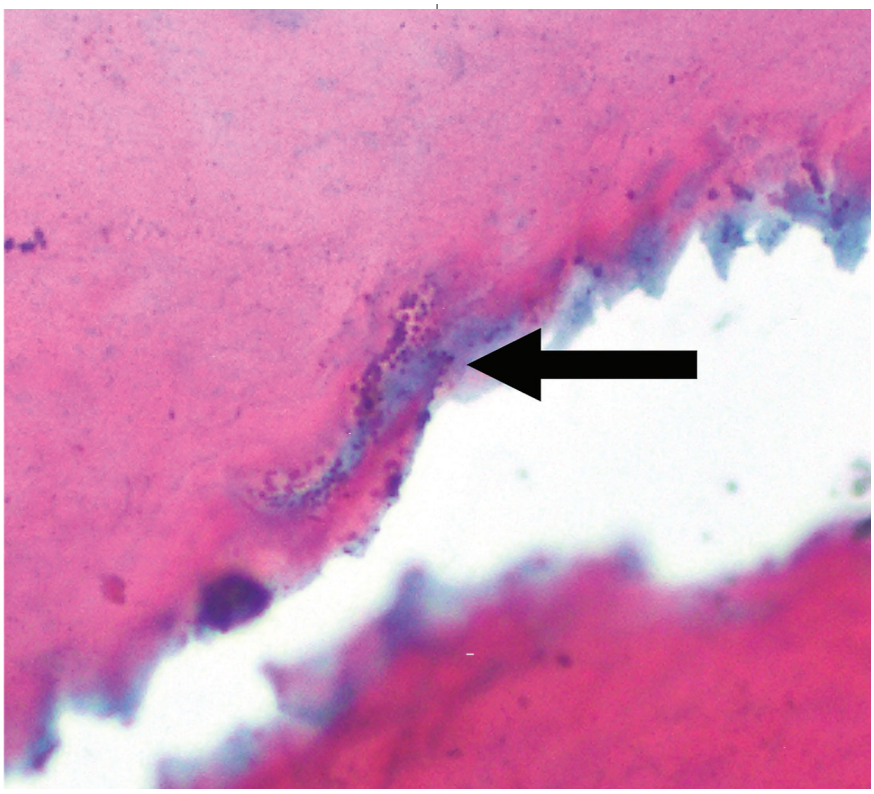

Figure 2. Gram stain of nail clippings from the affected thumbnail at 40x magnification. Bacilli were adherent to the nail plate surface (arrow).

Discussion

GNS typically presents as a triad of chronic paronychia, distolateral onycholysis, and a bluish-green discoloration of the nail plate.[1] Pseudomonas infection is the most common etiology, less often staphylococcus or streptococcus species.[1] The greenish discoloration of the nail plate is attributed to pyocyanin and pyoverdine pigments produced by pseudomonas.[1] Pseudomonas is a gram-negative aerobic coccobacillus that is ubiquitous in nature and preferentially grows in moist environments.[2] It is not typically found on the skin because the skin is relatively dry. However, certain predisposing factors can enable pseudomonas to proliferate on the skin.[1,2] These include trauma, burns, prolonged water exposure (especially occupational exposure, including barbers, dishwashers, bakers, and medical personnel), use of soaps and detergents, immunosuppression, and skin conditions that cause nail dystrophy (eg, onychomycosis, psoriasis, eczema) serving as an entry point for bacteria.[1,3,4] Coexisting onychomycosis is especially common in patients with GNS, with one study reporting up to 65% of patients with fungal coinfection.[4]

Potential risk factors in our patient included longstanding onychomycosis leading to onychodystrophy of both fingernails and toenails. His sputum was a suspected source of the pseudomonas spreading to his fingernails during his frequent bouts of coughing. His presentation of GNS was atypical in the sense that there was no significant paronychia, with absence of the usual nailfold tenderness, erythema, and edema.[1] However, inflammation was likely present, at least subclinically, as evidenced by reactive, focally increased melanin in the nail plate.5 Another atypical feature is the linear morphology mimicking longitudinal melanonychia, as GNS usually appears as broader patches on the nail plate.

The differential for nail discoloration includes fungal infection (eg, opaque and yellow change, thickening, onycholysis, subungual debris), longitudinal melanonychia (eg, linear band because of normal variation, neoplasm, or even an exogenous source such as a green slime toy[6]), subungual hematoma (travels distally over time), or other exogenous exposures such as dyes[7] or medications that may cause nail discoloration. In particular, the antiepileptic agent retigabine can cause diffuse black-gray nail discoloration that can last years.[8]

A green color is strongly suggestive of pseudomonas but could also be exogenous. The diagnosis is usually made clinically, but a culture of nail clippings can be performed for confirmation if there are atypical features. Assessment for coexisting nail fungus is recommended, as it may be a risk factor for recurrence. The most sensitive means of detecting fungal nail infections is testing a nail clipping for histopathology rather than a culture.

The most critical entity to rule out is melanoma, which classically presents as solitary longitudinal melanonychia of uneven width, sometimes associated with pigmentation of the nailfold skin (ie, Hutchinson's sign). Notably, acral lentiginous melanoma is a subtype of melanoma that can affect the nail bed.[9] Early forms of acral lentiginous melanoma may have irregular brown-gray pigmentation visible only with dermatoscopy, whereas advanced stages may have black-gray discoloration, abnormal vascularization, or gross changes such as erosion or ulceration of the nail unit.[9] This can present subtly, and any history of change or growth warrants consideration of referral for possible nail matrix biopsy.[8] This is in contrast to ethnic pigmentation, presenting as multiple lesions of uniform width, usually in individuals with darker skin.

There is a lack of randomized clinical trials on treatment options for GNS. Most evidence is based on clinical case reports. First-line therapies usually consist of minimizing risk factors such as water exposure and prescribing topical antiseptics, including diluted household white vinegar (acetic acid) or bleach (sodium hypochlorite). Dilution ratios and treatment durations vary among studies, but a 4:1 ratio of liquids and daily 5-minute soaks for 1 to 3 months are common.[1,2,3] Topical antibiotics are generally not recommended, as they are less likely to adequately treat the infection and can lead to resistance.[1,2,3] Oral antibiotics that provide pseudomonas coverage can be considered when topical therapies do not lead to resolution or for significant pain suggestive of more systemic involvement.[3] Refractory cases may warrant nail removal.[2] Any concomitant nail fungal infection should be treated with oral antifungals, generally oral terbinafine or fluconazole.[10]

Conclusions

This is an unusual presentation of GNS mimicking melanonychia, with green color remaining a reliable indicator for pseudomonas infection, even if just a slight tinge and in the absence of overt infection. In our patient's situation, there was evidence of seeding from a pulmonary source, which should be not be overlooked during history gathering. The high incidence of concomitant onychomycosis emphasizes the importance of a thorough hand, foot, and nail examination.

References

1. Ard KL. Pseudomonas aeruginosa and other pseudomonas species. In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 9th ed*. Elsevier; 2019.
2. Schwartz RA, Reynoso-Vasquez N, Kapila R. Chloronychia: the Goldman-Fox syndrome – implications for patients and healthcare workers. *Indian J Dermatol.* 2020;65(1):1-4. https://doi.org/10.4103/ijd.ijd_277_19
3. Hur K, Cho S. Chloronychia caused by Pseudomonas oryzihabitans infection. *JAAD Case Rep.* 2020;6(9):918-920. https://doi.org/10.1016/j.jdcr.2020.07.040
4. Ohn J, Yu DA, Park H, Cho S, Mun JH. Green nail syndrome: analysis of the association with onychomycosis. *J Am Acad Dermatol.* 2020;83(3):940-942. https://doi.org/10.1016/j.jaad.2020.01.040
5. Dika E, Starace M, Lambertini M, et al. Oral and nail pigmentations: a useful parallelism for the clinician. *J Dtsch Dermatol Ges*. 2020;18(1):7-14. https://doi.org/10.1111/ddg.14023
6. Liang Y, Han XF, Ma L. Exogenous pigmentation presenting as longitudinal melanonychia in a child. *JAMA Dermatol*. 2020;156(1):101-102. https://doi.org/10.1001/jamadermatol.2019.3114
7. Chiriac A, Brzezinski P, Foia L, Marincu I. Chloronychia: green nail syndrome caused by *Pseudomonas aeruginosa* in elderly persons. *Clin Interv Aging*. 2015;10:265-267. https://doi.org/10.2147/cia.s75525
8. Brickel N, Hewett K, Rayner K, et al. Safety of retigabine in adults with partial-onset seizures after long-term exposure: focus on unexpected ophthalmological and dermatological events. *Epilepsy Behav.* 2020;102:106580. https://doi.org/10.1016/j.yebeh.2019.106580
9. Basurto-Lozada P, Molina-Aguilar C, Castaneda-Garcia C, et al. Acral lentiginous melanoma: basic facts, biological characteristics and research perspectives of an understudied disease. *Pigment Cell Melanoma Res*. 2021;34(1):59-71. https://doi.org/10.1111/pcmr.12885
10. Fungal diseases. In: Bolognia JL, Schaffer JV, Cerroni L, eds. *Dermatology. 4th ed.* Elsevier; 2018.