

# Chloronychia: green nail syndrome caused by *Pseudomonas aeruginosa* in elderly persons

Anca Chiriac<sup>1-3</sup>Piotr Brzezinski<sup>4</sup>Liliana Foia<sup>5</sup>Iosif Marincu<sup>6</sup>

<sup>1</sup>Apollonia University, <sup>2</sup>Nicolina Medical Center, Department of Dermatology, <sup>3</sup>"P.Poni" Institute of Macromolecular Chemistry, Iasi, Romania; <sup>4</sup>Department of Dermatology, 6th Military Support Unit, Ustka, Poland; <sup>5</sup>Grigore T. Popa University of Medicine and Pharmacy, Iasi, Romania; <sup>6</sup>Victor Babes University of Medicine and Pharmacy, Timisoara, Romania

**Abstract:** Green nails, also known as chloronychia or green nail syndrome, are characterized by green discoloration of the nail plate (greenish-yellow, greenish-brown, greenish-black), proximal chronic non-tender paronychia, and distolateral onycholysis. The cause is *Pseudomonas aeruginosa* infection of the nail plate in persons whose hands are constantly exposed to water, soaps, and detergents or are subject to mechanical trauma, especially in the elderly. Green or black coloration of the nails should raise suspicion for *Pseudomonas* infection and be treated with an oral quinolone (ciprofloxacin), particularly in aged patients. We present three cases of green nails in elderly persons.

**Keywords:** chloronychia, green nail syndrome, *Pseudomonas aeruginosa*, elderly

## Case series

### Case 1

A 67-year-old healthy retired man developed an asymptomatic greenish discoloration of the nail plate of the right toe nail over a period of 2 months. There was a history of chronic nail trauma prior to the discoloration, probably due to tight shoes. Dermatologic examination showed greenish-black discoloration, mild onychodystrophy of the entire nail plate, and distal onycholysis (Figure 1).

Bacteriologic culture of nail scrapings was positive for *Pseudomonas aeruginosa*. Fungal coinfection was excluded by potassium hydroxide preparation and culture. The nail plate was cured after 6 weeks of oral ciprofloxacin.

### Case 2

A 68-year-old gardener was seen during summer, after working in wet conditions, for green discoloration of his right finger nail, slight pruritus, and pain. On clinical examination, distal onycholysis and greenish discoloration were noticed on the nail plate starting from the distal edge (Figure 2).

Bacteriologic culture of nail scrapings was positive for *P. aeruginosa*. No fungal coinfection was proved. Cutting the distal part of the nail plate and application of topical gentamicin twice daily for 1 month were followed by positive results.

### Case 3

A 56-year-old man, diagnosed 1 year earlier with toenail onychomycosis, in the absence of any treatment, developed greenish discoloration of the entire nail plate. No signs of paronychia were noticed, only subungual hyperkeratosis (Figure 3).

Bacteriologic culture of nail scrapings was positive for *P. aeruginosa*. Direct mycologic examination of nail scrapings was positive and culture was positive for

Correspondence: Anca Chiriac  
Apollonia University, Nicolina Medical  
Center, Department of Dermatology,  
P Poni Institute of Macromolecular  
Chemistry, Strada Muzicii nr 2,  
Iasi, Romania  
Tel +407 2123 4999  
Email ancachiriac@yahoo.com



**Figure 1** Green coloration of the toe nail.

*Trichophyton rubrum*. The fungal infection was treated with itraconazole 200 mg/day 14 days per month for 3 months. Bacterial infection was cured after systemic administration of ciprofloxacin 500 mg/day for 3 weeks.

## Discussion

Bacterial infections of the nails are caused by Gram-negative bacteria, usually *P. aeruginosa*, but can also be caused by *Klebsiella* spp. and Gram-positive bacteria like *Staphylococcus aureus*.<sup>1,2</sup> *P. aeruginosa* is the most common pathogen causing bacterial nail infections, although it is rarely reported.<sup>3</sup> *P. aeruginosa* is a Gram-negative, aerobic, coccobacillus belonging to the Pseudomonadaceae family.



**Figure 2** Onycholysis and secondary *Pseudomonas aeruginosa* infection of the finger nail in a 68-year-old man.



**Figure 3** Onychomycosis, onychogryphosis, and chloronychia in a 56-year-old man. **Note:** Colonies of *Pseudomonas aeruginosa* grown on agar media.

These pathogens are widespread in nature, inhabiting soil, water, plants, and animals (including humans).

More than half of all clinical isolates produce the blue-green pigments pyoverdine and pyocyanin.<sup>2</sup> *P. aeruginosa* is an opportunistic human pathogen that can produce pulmonary, kidney, and urinary tract infections and even systemic infections. It can be also involved in soft tissue infections, skin and nail infections in immunocompetent subjects and patients with immune deficiency syndrome. *P. aeruginosa* is not part of normal skin flora, so *Pseudomonas* infections of the intact nail are rare. When infection occurs, *P. aeruginosa* colonizes moist regions of the skin, axillae, anogenital regions, and retroauricular areas.

The pathogenesis of nail infections caused by *P. aeruginosa* is not fully elucidated. Predisposing factors must be taken into consideration: onycholysis, onychotillomania, microtrauma to the nail-fold, chronic paronychia, chronic exposure to water, soaps, or detergents, and associated nail disorders, such as psoriasis.<sup>4</sup>

Onycholysis is characterized by separation of the nail plate from the nail bed; it is followed by secondary *Pseudomonas* infection, particularly when the nails are exposed to a warm and moist environment. A number of triggers for onycholysis have been reported, including psoriasis, onychomycosis, yellow nail syndrome, contact dermatitis, medications (doxycycline), endocrine disorders (acquired hypoparathyroidism),<sup>5</sup> constant local trauma, especially in elderly. Chloronychia is more common in homemakers, barbers, dishwashers, bakers, and medical personnel, and can be regarded as an occupationally triggered disease.<sup>6</sup>

Small cuttings from the affected nail and/or subungual debris should be sent to the laboratory for investigations. Gram stain coloration is performed presenting Gram-negative rods

with no particular arrangement; on cetrinide agar medium, *P. aeruginosa* expresses pyocyanin, a blue-green exopigment, and the colonies are flat, large, and oval, with a characteristic fruity smell.

Recently it has been reported a strong relation between fungal and *P. Aeruginosa* infection of the nail: fungal infection stimulates bacterial colonization within the nail and overgrowth of *P. Aeruginosa* in culture inhibits the isolation of fungus.<sup>7</sup> The differential diagnosis includes subungual hematoma, malignant melanoma, infections caused by other pathogens such as *Aspergillus*, *Candida*, and *Proteus*, and chemical exposure to solutions containing pyocyanin or pyoverdine.<sup>8</sup>

The treatment of chloronychia, especially in elderly people, is difficult in many cases and recommendations based on clinical trials are missing.<sup>3</sup> In the past, removal of the entire nail was a therapeutic option, but not nowadays. Treatment consists of cutting off the detached nail plate, brushing the nail bed with a 2% sodium hypochlorite solution twice daily, prevention of repeated immersion by wearing cotton and latex gloves and antibiotics administered topically and orally.

Topical silver sulfadiazine, ciprofloxacin, and gentamicin have also been reported to be valuable therapeutic options.<sup>9</sup> Topical antibiotics (polymyxin B or bacitracin) applied 2–4 times daily for 1–4 months have been demonstrated to be effective in immunocompetent patients.<sup>6</sup> Topical therapy with nadifloxacin applied once daily for several weeks was curative for two patients with acquired immune deficiency syndrome.<sup>4</sup> When topical therapies are not preferred by the patient, oral ciprofloxacin should be recommended for 2–3 weeks.

*Pseudomonas* infections of the nails are treated by fluoroquinolones, when necessary, in comparison with other

bacterial nail infections that require culture and sensitivity testing. This is the reason to recognize easily, by simple clinical observation of the color of the nails, especially in aged persons, to avoid unnecessary laboratory investigations and to save time.

## Conclusion

Green coloration of the nails should raise suspicion for *Pseudomonas* infection. Treatment with an oral quinolone (ciprofloxacin), particularly in aged patients when laboratory investigations are difficult to perform, could be a valuable option.

## Disclosure

The authors report no conflicts of interest in this work.

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