

Localized Whirlpool Folliculitis in a Football Player

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Pseudomonas aeruginosa folliculitis occurs in patients exposed to contaminated water. Most outbreaks are associated with whirlpools. The infection is characterized by follicular, erythematous papules and pustules located on immersed body surfaces. Most reported cases are the result of recreational water use, occur in a diffuse pattern, and are devoid of green pustular pigment changes. The case described occurred in a football player after whirlpool treatment for an ankle strain. Green pustules and a localized affected area are unusual aspects of this case.

P*seudomonas aeruginosa* is an aerobic, motile, gram-negative rod that inhabits areas of moisture. The organism can live in sinks, jet fuel, antiseptic solutions, soil, sewage, flowers, vegetables, insects, and warm- and cold-blooded animals.^{1,2} It can be present in the normal flora of the external ear, axillae, anogenital region, and intestines. The cutaneous manifestations of *P. aeruginosa* are as varied as its habitat and include otitis externa, malignant otitis externa, green nail syndrome, toe web infections, superinfections in antibiotic-treated acne vulgaris, superinfections in traumatized skin (burns, decubitus ulcers), "whirlpool" or "hot-tub" folliculitis, blastomycosis-like pyoderma, ecthyma gangrenosum, and necrotizing fasciitis.³

Case Report

A 20-year-old college student with no significant past medical history presented with an acute eruption on his left leg. The patient stated that the area was "sensitive to touch" prior to noticing the eruption. He denied fevers, chills, arthralgias, dysuria, cough, malaise, headache, sore throat, rhinorrhea, otalgia, and ocular complaints. The patient, a col-

lege football player, sustained a left ankle inversion sprain 2 days previously. Examination revealed multiple, 2- to 6-mm erythematous papules and pustules. The pustules had a distinct light green hue with a circumferential border of intense erythema (Figure 1). Many of the papules and pustules were folliculocentric. The eruption was clustered in two areas, separated by a few centimeters, on the medial aspect of the left leg. The area was tender, but without edema, and the base of surrounding skin was non-erythematous. There was no associated lymphadenopathy. Further questioning revealed that the patient received a 20-minute hot whirlpool treatment exclusively to the left leg (distal to the knee), approximately 24 hours prior to the eruption. Treatment with 250 mg ciprofloxacin orally twice daily for 7 days was initiated, but follow-up revealed that the patient took just one dose. The lesions resolved without sequela 5 days later.

Discussion

The first outbreak of whirlpool folliculitis was described by McCausland and Cox⁴ in 1975. Since then, there have been numerous reports of this entity associated with whirlpools and hot tubs, with fewer reports associated with waterslides, physiotherapy pools, swimming pools, and saunas. More recent variants of this entity include diving suit dermatitis⁵ and folliculitis attributed to use of synthetic bathing sponges,^{6,7} loofah sponges,⁸ and wax depilation.⁹

The predilection of *P. aeruginosa* for these locales and its users are based upon many factors. It is known that *P. aeruginosa* infects superhydrated stratum corneum.¹⁰ In addition, the organism can withstand temperatures up to 41.4°C,¹¹ and these high temperatures may, in turn, dilate follicular openings and afford easier accessibility.¹² The turbulence in whirlpools creates skin desquamation and provides organic carbon debris for bacterial overgrowth. High temperatures and ammonia excreted by bathers decrease the effectiveness of chlorine. Chloramines, the product of chlorine and ammonia, are inferior antibacterials.¹ Bathing suit or diving suit occlusion can

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FIGURE 1. Follicular, erythematous papules and green pustules on the leg.

facilitate *P. aeruginosa* infection,^{5,10,13} although several case reports reveal no garments being worn during exposure. Trauma promotes further bacterial penetration as evidenced by reports of infection after shaving and intense sponge use.^{6,8} Most outbreaks are associated with closed-cycle water units, which circulate a fixed amount of water.

P. aeruginosa involved in the first outbreak of whirlpool folliculitis were serotypes O:4 and O:11.⁴ Serotype O:11 represents the most commonly identified group in *Pseudomonas* folliculitis. Other less commonly identified serotypes are O:9, O:4, and O:1. "Non-O:11" serotypes have been associated with "non-whirlpool" *P. aeruginosa* folliculitis. Specifically, O:3 and O:16 have been isolated in synthetic sponges,⁶ while O:10 was found in a loofah sponge.⁸

The incubation period of *P. aeruginosa* folliculitis is usually between 8 and 48 hours. Previous reviews describe the lesions as erythematous papular and pustular eruptions, many with follicular pustules,¹⁴⁻¹⁷ and less commonly with macules, vesicles, and nodules. Frequently the areas are pruritic,^{2,3,6,18} and urticarial and papulourticarial lesions have been described.^{2,16,19} The eruption is limited to exposed areas, with the face and neck commonly spared in whirlpool-associated cases (the areas usually not immersed). The eruption may be distributed more predominantly under the bathing suit.

Associated symptoms include painful eyes, earache, sore throat, headache, fever, painful swollen breasts (in males and females), malaise, rhinorrhea, nausea, vomiting, and abdominal cramps.^{1,14-16,18} Thomas *et al*¹⁴ reported ocular symptoms in 75%, and

ear symptoms in 70%, of 117 persons affected by "Pseudomonas dermatitis" associated with a swimming pool. These symptoms do not imply systemic invasion. Rarely, pneumonia, otitis media, and urinary tract infections have been related to *Pseudomonas* in whirlpools.²⁰⁻²²

The eruption typically resolves in 7 to 14 days^{1,3,18,19} with occasional postinflammatory hyperpigmentation. Recurrent folliculitis after recurrent exposure has been documented,¹⁹ as well as a recurrence seen 3 months after initial exposure.² In one outbreak, 23% of affected persons had a recurrence after initial clearance, with one-half of these individuals receiving topical antibiotics.¹⁴

The clinical differential diagnosis of this eruption may include *Staphylococcus aureus* folliculitis, Majocchi's granuloma, eosinophilic pustular folliculitis, miliaria, secondary syphilis, insect bites, papular urticaria, scabies, and acne vulgaris.

Histopathologic examination displays an acute suppurative folliculitis: mild acanthosis and spongiosis of the epidermis, a distended and disrupted infundibulum with dense neutrophilic infiltrate and hair fragments found within the canal, neutrophils within the outer root sheath, and dense superficial and deep perivascular inflammatory cell infiltrate consisting of mononuclear cells and neutrophils.^{2,15,18,19,23} Small, deep dermal abscesses have been identified.^{15,19} Gram's stain may reveal slender, pink rods, and cultures of skin and suspected water can confirm the diagnosis.

The case presented is unique in several aspects. First, the eruption was seen in a remarkably localized

area. The green hue visualized in many of this patient's pustules is a characteristic of *P. aeruginosa*, and is well-described in green nail syndrome, toe web infections, and superinfections of burns and ulcers. *P. aeruginosa* folliculitis, however, is not generally regarded to display such characteristic pigment changes as was seen in this case.

The exposure time of 20 minutes and the small amount of body surface area treated seemed unlikely factors to yield an infection. However, it should be noted that the football player's legs had noticeable abrasions and scratches that may have contributed to entry into follicular orifices. This may explain the two discrete areas of clustering on the left leg. It is known that *P. aeruginosa* has a predilection for damaged epithelium,^{6,8,9,17} and an analogous situation occurs with ocular *Pseudomonas* infections after abrasions to the cornea by contact lenses.²⁴ Additionally, therapeutic whirlpools are smaller than those used for recreational purposes, and therefore have less circulating water with relatively more organic debris. The patient's ankle sprain did not considerably limit his ambulation, but it may be postulated that decreased blood flow secondary to rest could have limited immune response and recruitment. The patient did not experience any associated symptoms, except for localized tenderness, which is ascribed to the distal and focal area of exposure.

Preventive measures to avoid *P. aeruginosa* folliculitis include maintaining adequate chlorine levels (free chlorine of 1 ppm) and pH (7.2 to 7.8); changing water frequently; cleaning closed circulating systems frequently; avoiding bathing in whirlpools where there are/were numerous bathers; avoiding water with a cloudy film; and avoiding use of antibacterial soaps after exposure.^{1,18} This case suggests that these measures should be more strictly adhered to when treatment whirlpools are used for athletes with injuries—especially those with epithelial damage. Additionally, synthetic sponges and loofah sponges should be cleaned to remove any remaining organic debris, and dried to prevent colonization.^{6,8}

Treatment of *Pseudomonas* folliculitis is generally not indicated, as most eruptions are self-limited. Topical antimicrobials such as acetic acid, silver sulfadiazine, gentamicin, potassium permanganate, and chlorhexidine have been attempted.^{3,17,25} However, it is unclear whether treatment hastens resolution. In one case series, topical silver sulfadiazine and potassium permanganate did not affect follicular recurrence.¹⁷ In a larger series, treatment with unspecified topical antibiotics was associated with 50% (9 of 18) of the recurrences. Only 14% (8 of 56) of those who did not report recurrence were treated with topical antibiotics.¹⁴ Oral fluoroquinolones may be instituted

in widespread eruptions, recurrences,⁵ or in those patients with associated systemic findings. In immunocompromised patients, systemic therapy with aminoglycosides or anti-*Pseudomonas* cephalosporins (ceftazidime or cefepime) may be warranted, since spread from folliculitis to ecthyma gangrenosum has been documented.²⁶

REFERENCES

- Berger RS, Seifert MR: Whirlpool folliculitis: a review of its cause, treatment, and prevention. *Cutis* 45: 97-98, 1990.
- Sausker WF, Aeling JL, Fitzpatrick JE, Judson FN: *Pseudomonas* folliculitis acquired from a health spa whirlpool. *JAMA* 239: 2362-2365, 1978.
- Greene SL, Su WP, Muller SA: *Pseudomonas aeruginosa* infections of the skin. *Am Fam Physician* 29: 193-200, 1984.
- McCausland WJ, Cox PJ: *Pseudomonas* infection traced to a motel whirlpool. *J Environ Health* 37: 455-459, 1975.
- LaCour JP, Baze PE, Castanet J, Dubois D, Poundenx M, Ortonne JP: Diving suit dermatitis caused by *Pseudomonas aeruginosa*: two cases. *J Am Acad Dermatol* 31: 1055-1056, 1994.
- Maniatis AN, Karkavitsas C, Maniatis NA, Tsiftsakis E, Genimata V, Legakis NJ: *Pseudomonas aeruginosa* folliculitis due to non-O:11 serogroups: acquisition through use of contaminated synthetic sponges. *Clin Infect Dis* 21: 437-439, 1995.
- Huminer D, Shmueli H, Block C, Pitlik SD: Home-shower-bath *Pseudomonas* folliculitis. *Isr J Med Sci* 25: 44-55, 1989.
- Bottone EJ, Perez AA II: *Pseudomonas aeruginosa* folliculitis acquired through use of a contaminated loofah sponge: an unrecognized potential health problem. *J Clin Microbiol* 31: 480-483, 1993.
- Trüeb RM, Elsner P, Burg G: *Pseudomonas-aeruginosa*-follikulitis nach epilation. *Hautarzt* 44: 103-105, 1993.
- Hojyo-Tomoka MT, Marples RR, Kligman AM: *Pseudomonas* infection in superhydrated skin. *Arch Dermatol* 107: 723-727, 1973.
- Hoadley AW, Ajello G, Masterson N: Preliminary studies of fluorescent pseudomonads capable of growth at 41°C in swimming pool waters. *Appl Environ Microbiol* 29: 527-531, 1975.
- Washburn J, Jacobson JA, Marston E, Thorsen B: *Pseudomonas aeruginosa* rash associated with a whirlpool. *JAMA* 235: 2205-2207, 1976.
- Vogt R, LaRue D, Parry MF, Brokopp CD, Klauke D, et al: *Pseudomonas aeruginosa* skin infections in persons using a whirlpool in Vermont. *J Clin Microbiol* 15: 571-574, 1982.
- Thomas P, Moore M, Bell E, Friedman S, Decker J, et al: *Pseudomonas* dermatitis associated with a swimming pool. *JAMA* 253: 1156-1159, 1985.
- Fox AB, Hambrick GW: Recreationally associated *Pseudomonas aeruginosa* folliculitis. *Arch Dermatol* 120: 1304-1307, 1984.

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16. Ratnam S, Hogan K, March SB, Butler RW: Whirlpool-associated folliculitis caused by *Pseudomonas aeruginosa*: report of an outbreak and review. *J Clin Microbiol* 23: 655-659, 1986.
17. Alomar A, Ausina V, Vernis J, de Moragas JM: *Pseudomonas* folliculitis. *Cutis* 30: 405-409, 1982.
18. Chandrasekar PH, Rolston KVI, Kannangara W, LeFrock JL, Binnick SA: Hot tub-associated dermatitis due to *Pseudomonas aeruginosa*. *Arch Dermatol* 120: 1337-1340, 1984.
19. Silverman AR, Nieland ML: Hot tub dermatitis: a familial outbreak of *Pseudomonas* folliculitis. *J Am Acad Dermatol* 8: 153-156, 1983.
20. McCutchan J, Rutala WA, Holdway R, Laws T, King N, Hines MP: Otitis due to *Pseudomonas aeruginosa* serotype O:10 associated with a mobile redwood hot tub system-North Carolina. *Morbid Mortal Weekly Rep* 31: 541-542, 1982.
21. Rose HD, Franson TR, Sheth NK, Chusid MJ, Macher AM, Zeirdt CH: *Pseudomonas* pneumonia associated with use of a home whirlpool spa. *JAMA* 250: 2027-2029, 1983.
22. Salmen P, Dwyer DM, Vorse H, Kruse W: Whirlpool-associated *Pseudomonas aeruginosa* urinary tract infections. *JAMA* 250: 2025-2026, 1983.
23. Ackerman AB, Chongchitnant N, Sanchez J, Guo Y, Benin B, et al: Histologic Diagnosis of Inflammatory Skin Diseases—An Algorithmic Method Based upon Pattern Analysis, ed 2, pp 376-386. Baltimore, Williams & Wilkins, 1997.
24. Toder DS: *Pseudomonas aeruginosa*: ubiquitous pathogen. In, Mechanisms of Microbial Disease (Schaechter M, Medoff G, Eisenstein BI, eds), ed 2, pp 281-289. Baltimore, Williams & Wilkins, 1993.
25. Rasmussen JE, Graves WH III: *Pseudomonas*, hot tubs, and skin infections. *Am J Dis Child* 136: 553-554, 1982.
26. El Baze P, Thyss A, Caldani C, Juhlin L, Schneider M, et al: *Pseudomonas aeruginosa* O-11 folliculitis: development into ecthyma gangrenosum in immunosuppressed patients. *Arch Dermatol* 121: 873, 1985.