

Greenish-blue staining of underclothing due to *Pseudomonas aeruginosa* infection of intertriginous dermatitis

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Abstract

Intertrigo (intertriginous dermatitis) is an inflammatory condition of the skin folds, induced or aggravated by heat, moisture, maceration, friction, and lack of air circulation. Intertrigo can become secondarily infected. Three cases of intertrigo are described herein which presented with greenish-blue staining of underclothing. Cultures revealed *Pseudomonas aeruginosa* which is a gram-negative aerobic bacillus that produces the pigments pyocyanin and pyoverdin that responsible for this characteristic hue. All three patients responded to a course of oral ciprofloxacin with resolution of the intertriginous dermatitis. Therefore, greenish-blue staining of clothing is an important indicator for pseudomonal intertrigo.

Keywords: *Pseudomonas aeruginosa*, Pyocyanin, Pyoverdin, Intertrigo.

Introduction

Intertrigo (intertriginous dermatitis) is an inflammatory condition of the skin folds, induced or aggravated by heat, moisture, maceration, friction, and lack of air circulation. It therefore has a predilection for moist areas such as the axilla, perineum, inframammary creases, neck and abdominal folds. Intertrigo can become colonised or secondarily infected, most often by *Candida* species, but also by bacterial, fungal, or viral pathogens.^{1,2} Three patients with intertrigo are reported herein that presented with greenish-blue staining of their underclothing, and the culture of the affected skin grew *Pseudomonas aeruginosa*.

Case Reports

Case-1

A 55-year-old woman presented with recurrent intertrigo with greenish-blue staining of her panties and bra since 2 years with no response to topical antifungals and corticosteroids (Figure-1). On



Figure-1: Greenish-blue stained bra of case 1.

examination, a mild erythematous appearance was detected in the inframammary and inguinal folds and the underclothes were stained a greenish-blue hue in the corresponding areas. Microscopic examination of a scraping from the inframammary region with 20% potassium hydroxide was negative for dermatophytes and yeasts. Culture of the area grew *P. aeruginosa*, *Klebsiella pneumoniae* and coagulase-negative staphylococci. The rash cleared after two weeks of treatment with oral ciprofloxacin 500 mg twice daily and bacitracin-neomycin sulfate ointment 3 times daily. There was no further staining of underclothing after the completion of the treatment.

Case-2

A 58-year-old woman presented with erythematous lesions on the inguinal region and blue-green staining of her panties since 3 years with no response to topical antifungals and corticosteroids. Dermatological examination revealed erythematous and macerated plaques and papules in the inguinal folds bilaterally with greenish-blue staining of the underwear (Figure-2). A Wood's light examination was performed but fluorescence was not observed and potassium hydroxide examination was also negative. A culture from the inguinal region demonstrated the presence of *P. aeruginosa* and coagulase-negative

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Figure-2: Greenish-blue discoloration of panties of case 2.

staphylococcus. She received two weeks of treatment with oral ciprofloxacin, topical 1% gentian violet and bacitracin-neomycin sulfate ointment with complete resolution.

Case-3

A 48-year-old woman presented with erythematous follicular and papulopustular lesions on the front and nape of the neck and inframammary folds. On dermatological examination, a mild erythematous and macerated appearance was observed in addition to papulopustular lesions in the inframammary region. The neighbouring parts of underclothes were observed to be greenish-blue stained. There was greenish-blue staining of her bra which she described as turquoise-coloured. Culture of the inframammary skin produced a heavy growth of *P. Aeruginosa*, *Klebsiella pneumoniae* and coagulase-negative staphylococci. The lesions and inframammary dermatitis cleared with 1 week of treatment with oral ciprofloxacin 500 mg twice daily and gentamicin sulfate ointment. The follicular and papulopustular lesions were probably because of *P. aeruginosa* infection since they also responded to the treatment.

Discussion

Intertrigo is a superficial inflammatory skin disorder involving any area of the body where two opposing skin surfaces can touch, rub or chaff.^{1,2} Secondary cutaneous infections are commonly observed because of the moist

and damaged skin associated with intertrigo. *Staphylococcus aureus* may present alone or with group A beta-haemolytic streptococcus (GABHS).³ *Pseudomonas aeruginosa*, *Proteus mirabilis*, or *Proteus vulgaris* can also secondarily infect intertriginous areas as can a variety of fungi including yeasts, molds, and dermatophytes.^{1,2,4} Since the patients presented here had all failed therapy with topical antifungals and corticosteroids for their intertrigo, the affected area was cultured in search for bacterial pathogens and isolated *P. aeruginosa*.

Primary cutaneous manifestations of *P. aeruginosa* infection include pyoderma, infection of wounds, ulcers, and burns, omphalitis, digital intertrigo, green nail syndrome, folliculitis associated with the use of swimming pool, whirlpool, and hot tubs and exacerbation of acne vulgaris.⁴ The presence of a greenish exudate, which is fluorescent under Wood's light and smells of ripe fruit, is very characteristic of *Pseudomonas* infection.⁵ *P. aeruginosa* produces multiple hydrosoluble pigments, the most important of which are pyocyanin and pyoverdin which are responsible for the characteristic greenish blue discoloration of *Pseudomonas* infection. Pyocyanin is a non-fluorescent blue redox-active secondary metabolite, greenish-blue in colour and has an essential role in the virulence of *P. aeruginosa*. Pyoverdin is a greenish yellow coloured pigment which is fluorescent under Wood's light and can be seen in all pseudomonads and represents a marker for bacterial differentiation. Some species produce trimethylamine, an organic metabolite responsible for the sweet, fruity, grape-like odour so characteristic of these infections.^{5,6} All three of our cases had greenish-blue staining of their underclothing which can be attributed to pyocyanin and pyoverdin production by *P. aeruginosa*.

Yilmaz et al reported a patient with erythroderma and anticonvulsant hypersensitivity syndrome who developed pseudomonal intertrigo in the inguinal region. Green staining of the underwear was thought to be a diagnostic sign for pseudomonal infection.⁷ Kaya et al also reported a similar case of pseudomonal inguinal intertrigo with blue discoloration of the underpants.⁸

Not only can *P. aeruginosa* secondarily infect intertriginous areas, it can additionally cause folliculitis as occurred in our third patient. Outbreaks of pseudomonas folliculitis associated with the use of under-chlorinated whirlpools, hot tubs, swimming pools, saunas, and

hydrotherapy pools have also been reported. Patients often present with follicular, macular, papular, vesicular, or pustular lesions on any part of the body usually starting 8-48 h after exposure.⁹

Conclusion

We need to be aware that intertrigo can result in greenish-blue staining of underclothing if secondarily infected with *P. aeruginosa* and consider empirical anti-pseudomonal treatment in a patient that presents with this condition. Ciprofloxacin appears to be a good choice in the outpatient setting for management of uncomplicated primary pseudomonal cutaneous infections.

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