



12-4-2016

Staphylococcus simulans: An emerging cutaneous pathogen

Bridget E Shields

University of Wisconsin-Madison

Amanda J Tschetter

University of Minnesota

Karolyn A Wanat

University of Iowa

DOI: <https://doi.org/10.1016/j.jdcr.2016.08.015>

© 2016 by the American Academy of Dermatology, Inc.

Creative Commons License



This work is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

JAAD Case Reports 2016;2:428-9. <http://dx.doi.org/10.1016/j.jdcr.2016.08.015>

Hosted by Iowa Research Online. For more information please contact: lib-ir@uiowa.edu.

Staphylococcus simulans: An emerging cutaneous pathogen



Bridget E. Shields, MD,^a Amanda J. Tschetter, MD,^b and Karolyn A. Wanat, MD^{c,d}
 Madison, Wisconsin; Pittsburgh, Pennsylvania; and Iowa City, Iowa

Key words: coagulase-negative staphylococci; matrix-assisted laser desorption ionization time-of-flight; Pantone-Valentine leukocidin; soft tissue infection; staphylococcal enterotoxins; *Staphylococcus simulans*; ulceration.

INTRODUCTION

Coagulase-negative staphylococci (CoNS), once an umbrella term for normal skin microbiota, are increasingly implicated in hospital-acquired infections. Quick, easy, and accurate speciation of CoNS via matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF-MS) was recently validated.¹ Integrating this technology into hospital laboratories has allowed multiple members of the genus to surface as potential human pathogens.¹ We report a case of *Staphylococcus simulans* causing a skin and soft tissue infection to alert dermatologists to this emerging CoNS pathogen.

CASE REPORT

A retired farmer, in his 80s, with osteoarthritis and bilateral knee replacements presented for evaluation of right toe swelling of 5 months' duration. Gout and other crystalline arthropathies were ruled out at initial examination. He was treated previously with 10-day courses of clindamycin and ciprofloxacin with short-lived, mild improvement. Physical examination found violaceous erythema of the dorsal right great toe with an overlying 2-cm soft, mildly fluctuant nodule and a central 5-mm superficial erosion (Fig 1). Two 4-mm punch biopsies were performed: one for histopathology and one for tissue culture. Histopathology findings were remarkable for superficial ulceration with overlying fibrinopurulent debris and numerous bacterial cocci. Tissue culture from the biopsy grew oxacillin-susceptible *S simulans* identified with MALDI-TOF-MS. Magnetic



Fig 1. Clinical picture of *S simulans* infection. Violaceous erythema of the dorsal right great toe with an overlying mildly fluctuant nodule and central superficial erosion.

resonance imaging excluded osteomyelitis, and serum uric acid level was normal. He was initially treated with cephalexin with minimal improvement after 7 days and no improvement after 14 days of doxycycline. Culture and sensitivities grew 2 strains of *S simulans*, one of which was sensitive and one that was resistant to tetracycline. The patient ultimately had complete resolution after 28 days of trimethoprim-sulfamethoxazole. This drug was chosen based on the results of the MALDI-TOF-MS speciation and susceptibilities of both strains, which were sensitive to trimethoprim-sulfamethoxazole.

From the Department of Dermatology, University of Wisconsin Hospital and Clinics^a; the Department of Micrographics Surgery and Dermatologic Oncology, Zitelli & Brodland PC^b; and the Departments of Dermatology^c and Pathology,^d the University of Iowa Hospitals and Clinics.

Dr Tschetter is currently affiliated with the Department of Dermatology, University of Minnesota, Minneapolis.

Funding sources: None.

Conflicts of interest: None declared.

Correspondence to: Karolyn A. Wanat, MD, Department of Dermatology, University of Iowa, 200 Hawkins Drive, Iowa City, Iowa 52242. E-mail: Karolyn-Wanat@uiowa.edu.

JAAD Case Reports 2016;2:428-9.

2352-5126

© 2016 by the American Academy of Dermatology, Inc. Published by Elsevier, Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<http://dx.doi.org/10.1016/j.jdc.2016.08.015>

Table I. Documented virulence factors shared between *S aureus* and coagulase-negative staphylococci.^{2,6,7}

Staphylococcal species	Virulence factors
<i>S aureus</i>	eta, etb, seg, she, sei, se1j, se1k, se1l, se1m, se1n, se1o, se1p, se1r, ses, set, se1u, se1v, tsst-1, mecA, pvl
<i>Staphylococcus epidermidis</i>	seh, sej, mecA
<i>Staphylococcus haemolyticus</i>	seh, sej, mecA, pvl
<i>Staphylococcus hominis</i>	seh, sej
<i>S lugdunensis</i>	seh
<i>S schleiferi</i>	seh, sej, mecA
<i>Staphylococcus saprophyticus</i>	seh, sej
<i>S simulans</i>	seh, sej, mecA, pvl
<i>Staphylococcus xylosum</i>	seh, mecA

eta, Exfoliative toxin a; etb, exfoliative toxin b; se, staphylococcal enterotoxinlike toxin; tsst, toxic shock syndrome toxin-1.

DISCUSSION

S simulans is a CoNS and a well-established animal pathogen affecting cows, sheep, goats, and horses. It is commonly implicated in bovine mastitis.² Reports of *S simulans* as the sole pathogen in human infections are rare; however, we hypothesize that our patient may have acquired infection from his farm and regular handling of animals, an identifiable risk factor. *S simulans* has also been implicated in osteoarticular infections, native valve endocarditis, and diabetic osteitis,³⁻⁵ with diabetes and prosthetic joints identified as additional risk factors.

Previously classified as rare opportunistic agents, *Staphylococcus lugdunensis* and *Staphylococcus schleiferi* are additional CoNS with emerging pathogenicity.⁶ Limited data exist explaining how these species are gaining pathogenicity, but shared virulence factors with *Staphylococcus aureus* have been documented in infectious animal isolates, including staphylococcal enterotoxins, tissue necrosis cytotoxin Panton-Valentine leukocidin (pvl), and the methicillin-resistance gene, *mecA* (Table I).^{2,6} Importantly, *mecA*-positive CoNS are able to horizontally transfer their genes within the staphylococcal genus with the potential to give rise to new methicillin-resistant strains.² Theoretically, with horizontal gene transfer possible, staphylococcal strains could acquire the ability to generate superantigens and cytotoxins, amplifying their virulence. Of particular dermatologic importance is the presence of pvl-producing *S simulans*, as pvl-positive strains of *S aureus* have been preferentially linked to furuncles, cutaneous abscesses, and severe skin necrosis.⁷ These virulence factors are not routinely tested for in human cultures nor reported in our patient.

Consistent with this case, CoNS cases can be difficult to treat because of multidrug resistance and varying susceptibilities among strains.² This

finding further highlights the need for precise speciation and sensitivity detection with a low threshold for treatment alteration when clinical improvement does not occur. Cultured CoNS strains are often not speciated, making it difficult to monitor for antibiotic resistance and impossible to identify horizontal gene transfer of virulence factors.⁶

Adequate speciation and susceptibility determination in skin and soft tissue infections is increasingly important. Dermatologists should be aware of *S simulans* and other CoNS species as potential pathogens and understand the origin of these newly named bacteria as MALDI-TOF-MS technology becomes more widely available.

REFERENCES

1. Carpaj N, Willems RJ, Bonten MJ, et al. Comparison of the identification of coagulase-negative staphylococci by matrix-assisted laser desorption ionization time-of-flight mass spectrometry and *tuf* sequencing. *Eur J Clin Microbiol Infect Dis*. 2011;30:1169-1172.
2. Unal N, Cinar OD. Detection of staphylococcal enterotoxin, methicillin-resistant and Panton-Valentine leukocidin genes in coagulase-negative staphylococci isolated from cows and ewes with subclinical mastitis. *Trop Anim Health Prod*. 2012;44:369-375.
3. Mallet M, Loiez C, Melliez H, Yazdanpanah Y, Senneville E, Lemaire X. *Staphylococcus simulans* as an authentic pathogenic agent of osteoarticular infections. *Infection*. 2011;39:473-476.
4. Vallianou N, Evangelopoulos A, Makri P, et al. Vertebral osteomyelitis and native valve endocarditis due to *Staphylococcus simulans*: a case report. *J Med Case Rep*. 2008;2:183.
5. Désidéri-Vaillant C, Nédelec Y, Guichon JM, et al. *Staphylococcus simulans* osteitis in a diabetic patient. *Diabetes Metab*. 2011;37:560-562.
6. Davis MF, Cain CL, Brazil AM, et al. Two coagulase-negative staphylococci emerging as potential zoonotic pathogens: wolves in sheep's clothing? *Front Microbiol* 2013;4:123.
7. Lina G, Piemont Y, Godail-Gamot F, et al. Involvement of Pantone-Valentine leukocidin-producing *Staphylococcus aureus* in primary skin infections and pneumonia. *Clin Infect Dis*. 1999;29:1128-1132.