Staphylococcus aureus carriage rates and antibiotic resistance patterns in patients with acne vulgaris

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Background: Overuse of antibiotics has led to the development of antibiotic-resistant strains of *Staphylococcus aureus*, which are occurring more frequently within the community.

Objective: We sought to determine whether long-term antibiotic therapy for acne alter the carriage rate and antibiotic resistance profiles of *S aureus*.

Methods: This was a prospective, cross-sectional, quasiexperimental study. Samples of anterior nares were obtained from dermatology patients given a diagnosis of acne vulgaris (n = 263) who were treated with antibiotics (n = 142) or who were not treated with antibiotics (n = 121). Specimens were tested for the presence of *S aureus* by growth on mannitol salt agar and then isolated on 5% sheep blood agar. Identification was confirmed based on colonial morphology, Gram stain, catalase, and coagulase testing. Antibiotic susceptibility testing was performed using the VITEK 2 system (bioMerieux, Marcy-l'Étoile, France).

Results: The *S aureus* carriage rate was significantly lower in patients with acne treated with antibiotics (6.3%) compared with those not treated with antibiotics (15.7%; $P = .016$). The percentage of *S aureus* isolates resistant to 1 or more antibiotics did not significantly differ between the 2 groups ($P = .434$).

Limitations: Cross-sectional study, patient compliance, and effects of prior acne treatments are limitations.

Conclusion: Treatment of patients with acne using antibiotics decreases the *S aureus* carriage rate but does not significantly alter the antibiotic resistance rates. (J Am Acad Dermatol 2016;74:673-8.)

Key words: acne vulgaris; antibiotic resistance; inducible clindamycin resistance; isotretinoin; methicillin-resistant *Staphylococcus aureus*; oral antibiotics; *Propionibacterium acnes*; *Staphylococcus aureus*; topical antibiotics.

Acne vulgaris is a common dermatologic disorder with an incidence of approximately 85% in adolescents and young adults.[1] Treatment options include topical antibiotics, topical retinoids, benzoyl peroxide, oral antibiotics, and isotretinoin. Antibiotics are generally prescribed for cases of moderate to severe acne; long-term antibiotic use may alter the normal microbial flora. There is concern regarding potential increasing resistance of *Propionibacterium acnes* and *Staphylococcus aureus* to antibiotics that are commonly used to treat acne.

Resistance by *P acnes* to antibiotics has previously been described and reported.[2-5] Topical application of clindamycin and erythromycin has been shown to be a risk factor for *P acnes* resistance.[6]

Approximately 33% of the US population is colonized in the nares with *S aureus*, of which 2.0% is methicillin-resistant *S aureus* (MRSA).[7-9] Further, the Centers for Disease Control and Prevention reports an estimated overall incidence or 65,296 cases of invasive MRSA with 15,138 of the cases classified as community-acquired invasive MRSA infections.[9,10] MRSA-associated

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Funding sources: None.
Conflicts of interest: None declared.
Accepted for publication November 16, 2015.

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Published online January 14, 2016.
0190-9622/$36.00

http://dx.doi.org/10.1016/j.jaad.2015.11.025

community-acquired infections generally show resistance to beta-lactam antibiotic and erythromycin.[10-15]

Although clindamycin is an effective treatment option for MRSA infections, inducible clindamycin resistance (ICR) may limit its use in treatment of skin infections where an isolate may be resistant to both erythromycin and clindamycin. Cross-resistance to erythromycin and clindamycin shows high minimum inhibitory concentrations for both erythromycin and clindamycin, which has been attributed to ribosomal mutations.[16]

Potential antibiotic resistance to both *P acnes* and *S aureus* is a significant concern for patients with acne vulgaris, yet there is limited prospective research in outpatient settings to determine if these concerns are valid.

CAPSULE SUMMARY

- Antibiotic overuse, especially in dermatology, has resulted in antibiotic resistance concerns.
- Antibiotic use in patients with acne significantly lowered the prevalence of *Staphylococcus aureus* colonization, but did not result in increased antibiotic resistance.
- Antibiotic prescribing practices for acne may have the positive unintended consequence of lowering *S aureus* colonization.

METHODS

Study design

This was a prospective, cross-sectional, quasiexperimental study (Fig 1) without random assignment, which compared colonization of *S aureus* in 263 consenting patients undergoing treatment for clinically diagnosed acne. This cohort was a convenience sample from the private practices of 2 northeastern Ohio dermatologists collected from 2013 to 2014. Informed consent approved by the Youngstown State University Institutional Review Board was obtained from all participants.

With the assistance of the investigators, participants completed a comprehensive survey that included data on gender, age, occupation, current or recent antibiotic use, and history of acne treatment. Individuals who indicated antibiotic use within the past 3 months for conditions other than acne and those in a health care–related occupation were excluded from the study.

Sample collection and determination of *S aureus* growth and antibiotic resistance

Specimens were collected with a sterile polyester swab from the anterior nares by rotating the swab 5 times in each nostril with light pressure. The samples were immediately inoculated onto mannitol salt agar and delivered to the laboratory within 8 hours. The mannitol salt agar plates were streaked for isolation and incubated at 35°C to 37°C for up to 48 hours. Those colonies suspected as *S aureus* were subcultured onto 5% sheep blood agar plates (Remel, Lenexa, KS) for isolation and isolated colonies tested for catalase and coagulase activity. Those colonies that were catalase positive and coagulase positive were identified as *S aureus*. Antibiotic susceptibility testing was performed on all *S aureus* isolates using the VITEK 2 system (bioMerieux, Marcy-l'Étoile, France). Antibiotics tested were oxacillin, gentamycin, ciprofloxacin, levofloxacin, moxifloxacin, erythromycin, clindamycin, linezolid daptomycin, vancomycin, doxycycline, tetracycline, tigecycline, nitrofurantoin, rifampicin, and trimethoprim-sulfamethoxazole. Isolates were also tested for ICR and methicillin resistance with the cefoxitin screen.

Statistical analysis

Software (SPSS, IBM Corp, Armonk, NY) was used for analysis of descriptive statistics and frequencies of the total test group and for the antibacterial and control groups. Fisher exact test statistic and logistic regression analysis were performed to determine if antibiotic use, gender, participant age, or duration of antibiotic therapy predicted for carriage of *S aureus*.

RESULTS

The study demographics and colonization rate are summarized in Table I. The mean age in the study was 22.5 years with SEM of 0.66 years; the median age was 18 years. There were 103 (39.2%) male and 160 (60.8%) female participants. Of the 263 participants, 142 (54.0%) were treated with antibiotics and comprised the antibacterial group. Within the antibacterial group, 79 (17.0%) were treated with oral antibiotics; 23 (4.9%) were treated with topical antibiotics; and 40 (15.2%) were treated with a combination of both oral and topical antibiotics. The average duration of antibiotic use in the antibacterial group was 11.1 months. The control group consisted of the remaining 121 (46.0%), who were not treated with either oral or topical antibiotics.

Of the participants, 28 (10.6%) were colonized with *S aureus*. Those using antibiotics were less likely to be colonized by *S aureus* (6.3%) than those not using antibiotics (15.7%). The Fisher