

Original research article

## A Prospective Study on Hospitalized Dermatology Patients and Analysis of Antibiotic Susceptibilities of Skin Wound Flora in Lucknow

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### Abstract

**Background:** Results of an ongoing surveillance of antibiotic resistance in hospitalized dermatology patients are presented. Bacterial isolates cultured from patients with skin wounds admitted to a tertiary care dermatology inpatient unit from May 2020 through Oct 2021 were evaluated for resistance to commonly used antibiotics. Our results show an alarming trend toward antibiotic resistance

**Observation:** In superficial skin wounds, *Staphylococcus aureus* constituted 77% of isolates. In leg ulcers, the frequencies of *S aureus* and *Pseudomonas aeruginosa* were approximately equal, constituting 43% and 42% of cultures, respectively. Fifty percent of *S aureus* isolates from leg ulcers were resistant to oxacillin, with 36% of pseudomonad isolates resistant to ciprofloxacin. In superficial wounds, oxacillin resistance in *S aureus* approached 25%. A comparison of antibiotic resistance profiles using data collected in 1992 for patients admitted to the same inpatient service revealed a marked increase in oxacillin and ciprofloxacin resistance in *S aureus* and *P aeruginosa* in leg ulcers, respectively (from 24% to 50% oxacillin resistance in *S aureus* and from 9% to 24% ciprofloxacin resistance in *P aeruginosa*), and superficial wounds (24% to 36% ciprofloxacin resistance in *P aeruginosa*).

**Conclusions:** This study demonstrates the rapid emergence of antibiotic-resistant bacteria as a problem of growing significance in hospital dermatology and highlights the importance of local surveillance programs to aid in selecting antibiotic treatments

**Keywords:** dermatophytes, tinea corporis, trichophyton

## Introduction

The importance of antibiotic resistance in dermatologic practice is increasing. This is of no surprise since staphylococcus, an important skin pathogen, was the first human isolate shown to have acquired the ability to cleave penicillin.<sup>1</sup> Despite this early warning, there has been an empirical tendency on the part of dermatologists to prescribe antibiotic treatments. Broad-spectrum agents with gram-positive activity are frequently chosen for skin infections and, likewise, chronic leg ulcers are often treated with quinolone antibiotics such as ciprofloxacin for pseudomonad and other gram-negative coverage. Various data, including a previous study by us,<sup>2-5</sup> ominous consequences of the antibiotic overuse of an have suggested regarding the acquisition of antibiotic resistance. In a study published in 1993, ciprofloxacin resistance was encountered in 19% of *Pseudomonas aeruginosa* and 40% of *Staphylococcus aureus* organisms isolated from chronic leg ulcers in hospitalized dermatology patients.<sup>2</sup> In addition, resistance of *S aureus* to oxacillin was encountered in 24% of leg ulcer isolates. In the present study, ongoing surveillance of the same patient base has revealed an alarming trend toward the rapid acquisition of antibiotic resistance. The crisis of antibiotic resistance has come rapidly to the (cutaneous) surface.

## PATIENTS AND METHODS

A prospective analysis of aerobic bacterial isolates was performed for patients with superficial skin wounds and leg ulcers admitted to the Department of Dermatology, Integral Institute of Medical Sciences and Research, Integral University, Lucknow. The types of superficial skin wounds by dermatologic diagnosis are as follows

## Results

A prospective study microbiologic analysis of bacterial wound cultures performed on hospitalized dermatology patients with superficial skin wounds and leg ulcers revealed 194 who had undergone skin wound culture over a 13-month period; charts of these persons were included in the study. The dominant culture composition was as follows:

Diagnosis	No. of Patients
<i>Psoriasis</i>	26
<i>Pemphigoid</i>	17
<i>Dermatitis, not otherwise specified</i>	17
<i>Atopic dermatitis</i>	15
<i>Mycosis fungoides</i>	14
<i>Pemphigus</i>	5
<i>Hidradenitis</i>	5
<i>Neurotic excoriations</i>	3
<i>Other dermatoses</i>	32
<b>Total</b>	<b>134</b>

**Table 1:** Hospital charts were reviewed for consecutive patients who underwent bacterial culture for cutaneous wounds. Swab cultures were processed on blood MacConkey phenylethyl alcohol thioglycolate agar. Bacterial isolates cultured at the time of hospital admission

<i>Cefazolin</i>	14	0	12
<i>Ciprofloxacin</i>	13	2	11
<i>Erythromycin</i>	16	0	10
<i>Oxacillin</i>	13	1	12
<i>Tetracycline</i>	8	2	16
<i>Penicillin</i>	25	0	1
<i>Vancomycin</i>	1	0	25
<i>aeruginosa</i> (n = 25)			
<i>Ciprofloxacin</i>	9	0	16
<i>Ofloxacin†</i>	7	5	10
<i>Ticarcillin</i>	2	0	23
<i>Gentamicin</i>	2	1	22
<i>Ceftazidime</i>	1	0	24

**Table 2:** Antibiogram for staphylococcus aureus and pseudomonas aeruginosa shows the susceptibility patterns of *S AUREUS* isolates from patients with leg ulcers. High-level antibiotic resistance was encountered for most agents evaluated. Only one culture (non-methicillin-resistant) was resistant to vancomycin, although the isolate was not retained and this result was unable to be further confirmed. Results of the evaluation of pseudomonad isolates in leg ulcers are also presented in Table 2. Most isolates were sensitive to ticarcillin and gentamicin, and only 1 culture showed resistance to the third-generation cephalosporin ceftazidime. A similar analysis was performed for *S AUREUS* and *P AERUGINOSA* isolates from superficially wounded skin

## Discussion

Our results of research in hospitalized dermatology patients show an alarming trend toward antibiotic resistance. A comparison of antibiotic susceptibilities of *S aureus* and *P aeruginosa* in this survey with those determined in the previous analysis shows the emergence of alarming trends in antibiotic resistance. Resistance of both organisms to ciprofloxacin and of *S aureus* to oxacillin in both wound types studied were either statistically significant or within limits of a trend toward significance. Particularly striking was the marked increase in oxacillin resistance that occurred over an approximate 4-year period. A doubling of oxacillin resistance was noted in *S aureus* cultured from leg ulcers when compared with the 1992 survey. Presently, 50% of isolates are resistant to oxacillin compared with 24% previously. This finding can be further appreciated by comparison with the hospital antibiogram, which shows 40% prevalence of oxacillin resistance in *S aureus* isolates from all sources and which is largely reflective of nosocomial pathogens. In contrast, oxacillin resistance in our leg ulcer population was measured in cultures obtained at the time of admission and may represent an evolving flora rather than dominant nosocomial spread. Even more ominous is a comparison of oxacillin resistance in *S aureus* cultured from superficial skin wounds. Whereas previously only 9% of isolates were resistant, present data show resistance in 24% of cultures—almost triple in occurrence. The marked increase in oxacillin resistance seen in *S aureus* from leg ulcers may be due in part to the chronic nature of the wound and frequent antibiotic exposure. Many of these patients have been receiving

long-term treatment, including prior hospital admissions as well as multiple courses of antibiotic therapy in the outpatient setting. The prevalence of *S aureus* strains resistant to other commonly used antibiotics has also increased markedly. In cultures isolated from leg ulcers, *S aureus* resistance to most antibiotic agents surveyed has become increasingly prominent. High-level resistance to ciprofloxacin by *P aeruginosa* in our patient population has also emerged. Our data exceed resistance prevalences reported in national surveillance studies. In a survey of quinolone resistance in 25 US hospitals, overall resistance of *P aeruginosa* to ciprofloxacin was found to be 7.8%.<sup>6</sup> In a European study, ciprofloxacin-resistant *P aeruginosa* was encountered in 13% of isolates.<sup>7</sup> Similar prevalence data for ciprofloxacin-resistant *P aeruginosa* in multicenter analyses have been published.<sup>8-11</sup> Therefore, the greater prominence of ciprofloxacin resistance encountered in our inpatient population cannot be explained solely on the basis of hospital environment or level of care. Rather, our data may reflect trends in dermatologic infections and may be associated with more frequent prescribing of ciprofloxacin by community dermatologists. Moreover, patients with *P aeruginosa* infections in chronic leg ulcers are frequently treated with ciprofloxacin empirically, which provides a selective pressure for the emergence of resistance to this antibiotic. This study and others highlight the rapid emergence of antibiotic-resistant bacteria as a problem of growing significance in dermatology.<sup>2,12-14</sup> While national databases contain limited information on this problem, the importance of local trends cannot be overstated.<sup>15-19</sup> Antibiotic prescribing habits differ markedly not only in different regions of the world but also within local communities. For example, the widespread use of ciprofloxacin to treat leg ulcer infections in local dermatologic practice may be at the root of the precipitous increase in ciprofloxacin resistance encountered in our inpatient surveillance. Furthermore, as managed care programs restrict the ability to choose agents, prescribing patterns can differ markedly between health care delivery systems bound by formulary constraints. Therefore, as illustrated herein, data on antimicrobial resistance patterns must be monitored with particular attention to local trends. Only then will directed intervention programs be effective in stemming the rapid evolution of antibiotic-resistant bacteria.

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