

Activity of Nine Antimicrobial Agents against *Corynebacterium* Group D2 Strains Isolated from Clinical Specimens and Skin

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The in vitro activities of nine antimicrobial agents against *Corynebacterium* group D2 strains isolated from clinical specimens and from healthy skin of hospitalized patients were studied. Ciprofloxacin, ofloxacin, norfloxacin, vancomycin, and teicoplanin were very active against these microorganisms. There were no significant differences in susceptibility between clinical and colonizing isolates.

Corynebacterium group D2 is a microorganism mainly isolated from urine samples which may be involved in asymptomatic bacteriuria, uncomplicated cystitis, encrusted cystitis, pyelonephritis, bacteremia, and endocarditis (5-7). This microorganism is highly resistant to most antimicrobial agents (4), as are other pathogenic corynebacteria such as group JK (3). On the other hand, during research which is now under way we isolated *Corynebacterium* group D2 from healthy human skin in patients at our hospital, another feature of similarity to group JK.

The aim of this investigation was twofold. First, we looked for new antimicrobial agents with potential in vitro activity against these widely and highly resistant microorganisms. Second, we tried to establish whether differences in antimicrobial susceptibility exist between *Corynebacterium* group D2 strains isolated from clinical specimens and from healthy skin of hospitalized patients.

A total of 113 *Corynebacterium* group D2 strains were studied: 58 strains were isolated from clinical specimens (56 from urine, 1 from a perirenal drainage, and 1 from blood) from different patients; 55 strains were isolated from healthy skin of 27 patients; 35 of these strains were isolated from 17 patients who had received antimicrobial treatment during the week before the microbiological study was performed.

The isolation of *Corynebacterium* group D2 from healthy skin was done with two selective media. Both consisted of Mueller-Hinton agar (Difco Laboratories, Detroit, Mich.), one with 64 µg of amikacin and 128 µg of ampicillin per ml and the other with 100 µg of ticarcillin, 64 µg of cefazolin, and 200 µg of flucytosine per ml and 5% human blood.

The drugs tested were ampicillin (Beecham Pharmaceuticals, Brentford, United Kingdom), erythromycin (Abbott Laboratories), vancomycin (Dista S.A.E., Barcelona, Spain), teicoplanin (Lepetit, SpA., Milan, Italy), norfloxacin and josamycin (Liade S.A., Madrid, Spain), ofloxacin (Hoechst A.G., Frankfurt, Federal Republic of Germany), ciprofloxacin (Bayer Chemicals, Leverkusen, Federal Republic of Germany), and gentamicin (Schering Corp., Bloomfield, N.J.).

The antimicrobial susceptibility test was done by an agar dilution method to determine the MICs of nine drugs (4). *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, and *Streptococcus faecalis* ATCC 29212 were used as controls.

The MICs of the nine antimicrobial agents tested against the 113 *Corynebacterium* group D2 isolates are shown in

Table 1. All the strains were susceptible to vancomycin and teicoplanin. Ciprofloxacin and ofloxacin were very active, with MICs for 90% of isolates equal to or less than 1 µg/ml. Norfloxacin was less active than the other quinolones but is potentially useful for urinary tract infections (MIC for 90% of isolates, 8 µg/ml). Only a few strains were susceptible to erythromycin, josamycin, ampicillin, and gentamicin, but there was no evident relationship between the susceptibility or resistance data for these strains and one or more drugs, with the exception of a cross-resistance between erythromycin and josamycin, the former being weight-by-weight more active than the latter.

There were no significant differences in antimicrobial susceptibility between clinical and colonizing isolates. The existence of previous antimicrobial chemotherapy did not influence susceptibility or resistance; furthermore, there were no data to suggest differences in antimicrobial susceptibility among skin isolates in relation to the composition of the selective medium used.

The antimicrobial susceptibility of clinical isolates of *Corynebacterium* group D2 was recently described (4). The most active antimicrobial agents were vancomycin and norfloxacin. Novobiocin and rifampin were also active against many isolates (4). In the present study, we showed that some new drugs, such as ciprofloxacin, ofloxacin, and teicoplanin, are also very active against *Corynebacterium* group D2. These three drugs may be satisfactory alternatives for the treatment of infections caused by this microorganism, not only when it produces urinary tract infections but also in systemic infections.

There were no significant differences in antimicrobial susceptibility between clinical and colonizing isolates. Previous antimicrobial chemotherapy seems not to have affected antimicrobial susceptibility of colonizing isolates. Nevertheless, all these strains were isolated from skin of hospitalized patients, and we were unable to evaluate the pressure of current antimicrobial agents, although we did not detect any horizontal transmission of *Corynebacterium* group D2 among inpatients. The selective medium used to isolate skin strains seems not to have affected the antimicrobial susceptibility pattern shown by colonizing isolates.

There were no significant differences in the antimicrobial susceptibility of skin isolates when different selective media were used, perhaps because most strains were beta-lactam and aminoglycoside resistant.

Human skin flora is very rich in coryneform bacteria, most of them susceptible to many antimicrobial agents (1). *Corynebacterium* groups D2 and JK are, however, part of the

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TABLE 1. Antimicrobial susceptibility of 113 *Corynebacterium* group D2 strains

Antimicrobial agent	MIC ($\mu\text{g/ml}$) ^a		
	Range	50%	90%
Vancomycin	0.25-0.5	0.5	0.5
Teicoplanin	≤ 0.12 -0.25	0.25	0.25
Erythromycin	≤ 0.12 ->1,024	512	>1,024
Josamycin	0.25->1,024	1,024	>1,024
Ampicillin ^b	≤ 64 ->1,024	>1,024	>1,024
Gentamicin	≤ 0.25 ->1,024	>1,024	>1,024
Ciprofloxacin	≤ 0.12 -4	≤ 0.12	1
Ofloxacin	≤ 0.12 -8	0.5	0.5
Norfloxacin	0.25->16	1	8

^a 50% and 90%, MICs for 50 and 90% of isolates, respectively.

^b MICs for all isolates, except three (MIC, ≤ 64 $\mu\text{g/ml}$), were equal to or higher than 512 $\mu\text{g/ml}$.

skin flora and are resistant to many drugs. It has been suggested that *Corynebacterium* group JK is a susceptible skin corynebacterium which, for different reasons, develops resistance to many antimicrobial agents (2). If this hypothesis was correct, it could also be speculated that *Corynebacterium* group D2 might also be a highly resistant variant of another normal skin coryneform bacterium. Nevertheless, we isolated *Corynebacterium* group D2 from healthy skin of patients who were not receiving antimicrobial agents but who were hospitalized. We have not been able to isolate this microorganism from skin of 100 healthy individuals or hospital staff (unpublished data).

Our results show that the antimicrobial susceptibility of *Corynebacterium* group D2 isolated from skin of hospitalized patients is quite similar to that of clinical isolates and

that there are no differences in susceptibility in relation to previous antimicrobial chemotherapy.

However, we do not have enough data to speculate on the probable origin of *Corynebacterium* group D2, which may be an individualized species or a multiresistant variant of another skin coryneform bacterium.

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