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Skin Colonization by *Corynebacterium* Groups D2 and JK in Hospitalized Patients

FRANCISCO SORIANO,[1]* JUAN L. RODRIGUEZ-TUDELA,[1] RICARDO FERNÁNDEZ-ROBLAS,[1] JOSÉ M. AGUADO,[2] AND MARGARITA SANTAMARÍA[1]

Departments of Microbiology[1] and Internal Medicine,[2] Fundación Jiménez Díaz, Avenida de Reyes Católicos 2, 28040 Madrid, Spain

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To determine the prevalence of *Corynebacterium* group D2 and JK organisms on the skin of different types of patients, 200 hospitalized subjects, half of them admitted to a university hospital and the others in a chronic care institution, were surveyed. Samples were taken from the axilla, groin, and abdominal wall. *Corynebacterium* group D2 and JK organisms were isolated from at least one of the three skin sites in both groups of patients. Only five patients harbored groups D2 and JK at the same time but at different skin sites. The rate of colonization by group D2 organisms was higher in females (43.3%) than in males (17.7%); on the contrary, group JK organisms were isolated more frequently from males (32.1%) than from females (13.5%). All these differences were statistically significant. *Corynebacterium* group D2 and JK organisms are widely distributed on the skin of hospitalized patients, and the prevalence is sex related.

Groups D2 and JK of the coryneform bacteria are commonly found on skin and mucous membranes. They are highly resistant to most antimicrobial agents (2, 6–8, 12–14). Group JK organisms have been isolated in cases of bacteremia, cutaneous infections at intravenous-catheter-entry sites, and pneumonia in immunocompromised hosts (3, 5, 7, 13, 14). These organisms may be acquired by nosocomial spread or from endogenous sources (3–5). On the other hand, the medical significance of group D2 has been recognized only recently, mainly in reports of urinary tract infections (1, 9). Groups D2 and JK have different biochemical characteristics, and the urease produced by the former may play a role in its pathogenicity (10, 11). The epidemiology of infections with D2 organisms is not well known, and most reported cases have involved patients clearly at risk of infection because of urologic manipulation. Since most urinary tract infections are caused by microorganisms harbored by the patients, we hypothesized that *Corynebacterium* group D2 could be a common skin colonizer which under favorable conditions could produce such infections.

In this study, we determined the prevalences of coryneform group D2 and JK organisms that colonized the healthy skin of patients admitted to two different hospitals.

(Parts of this work were presented previously [F. Soriano, J. L. Rodriguez-Tudela, J. M. Aguado, and R. Fernandez-Roblas, Program Abstr. 27th Intersci. Conf. Antimicrob. Agents Chemother., abstr. no. 107, 1987].)

Study population. Two hundred hospitalized patients, half of them admitted to a university hospital and the others in a chronic care institution, were sampled. In the first institution the patients surveyed were in four different wards (urology, hematology, oncology, and internal medicine). In the second institution, patients were in three different wards located on different floors. Each ward was attended by different nurses and ancillary personnel. All the subjects gave informed consent, were sampled only once, and were evaluated by means of a clinical protocol that collected information concerning age, sex, underlying diseases, and length of hospitalization. A patient was considered to be immunosuppressed when hematologic malignancies were present or when the patient underwent sustained treatment with immunosuppressive drugs or steroids.

Sampling technique. Axilla, groin, and abdominal wall (periumbilical) areas from hospitalized patients were cultured by using contact plates (25 cm^2) containing Mueller-Hinton agar (Difco Laboratories, Detroit, Mich.) supplemented with 100 μg of ticarcillin (Beecham Pharmaceuticals, Brentford, United Kingdom), 64 μg of cefazolin (Eli Lilly & Co., Indianapolis, Ind.), and 200 μg of flucytosine (Roche Laboratories, Nutley, N.J.) per ml and 5% human blood. All the plates were incubated at 35°C for 72 h.

Organism identification. Representative colonies were stained with Gram stain, and biochemical characterization of the isolates was performed as previously described (7).

Data analysis. The data were compared by using Student's *t* test to analyze the prevalence of group D2 organisms in both institutions. For the rest of the comparisons, χ^2 tests with Yates' correction were used.

The characteristics of the populations surveyed are shown in Table 1. Table 2 shows the prevalences of skin colonization by coryneform group D2 and JK organisms in the patients. When these microorganisms were isolated from a patient in more than one sample, only one isolate was considered for the analysis. Coryneform group D2 and JK organisms were isolated from patients in both hospitals. Group D2 organisms were isolated more often in patients hospitalized in the chronic care institution than in patients in the university hospital (37 versus 25%), although our data cannot prove such results to be statistically significant ($P = 0.08$). Group JK organisms were isolated at similar rates from patients in the university hospital and chronic care institution (23.5 and 20%, respectively). Only five patients (three females and two males) harbored group D2 and JK organisms at the same time but at different skin sites. There was no difference in the frequencies of colonization by group D2 and JK organisms in relation to age or immunosuppres-

* Corresponding author.

TABLE 1. Characteristics of populations surveyed for skin colonization by *Corynebacterium* groups D2 and JK

Population	No. of subjects			Age (yr)		No. with immunosuppression	Length of hospitalization when surveyed (days)	
	Total	Male	Female	Range	Mean		Range	Mean
University hospital	100	47	53	13–88	58.6	20	1–74	18.5
Chronic care institution	100	49	51	24–93	71.5	1	2–1,824	534

sion, the latter circumstance being infrequently found in our patients, especially at the chronic care institution.

Corynebacterium group D2 organisms were isolated at higher rates from females than males at the university hospital (39.6 and 8.5%; $P < 0.001$) and in the chronic care institution (47.1 and 26.5%; $P < 0.05$). Conversely, *Corynebacterium* group JK organisms were isolated at higher rates from males than females at the university hospital (43.7 and 11.3%; $P < 0.001$) and in the chronic care institution, although in the latter the difference was not statistically significant (24.5 and 15.7%; $P = 0.3$). The prevalences of D2 and JK organisms in both institutions considered as a whole were also sex related, group D2 being more prevalent in females (43.3%) than in males (17.7%). The opposite was observed with group JK, being more prevalent in males (32.1%) than in females (13.5%); all these differences were statistically significant ($P < 0.01$).

There was no clear increase in colonization of patients with D2 and JK organisms during hospitalization. At the chronic care institution, patients who had been hospitalized for between 6 and 24 months had a higher prevalence of skin colonization by group D2 and JK corynebacteria (69.2%) than those hospitalized for 0 to 6 months (40.5%) or more than 24 months (46.5%) ($P < 0.05$). The rates of skin colonization by group D2 and JK organisms were very different neither between patients admitted to the two hospitals (44 versus 53%) nor among the different wards, except in one ward of the chronic care institution where a rate of colonization of 92.9% was found. In this ward, we did not find any factor (age, sex, underlying disease, or immunosuppression) which could explain such a difference.

Coryneform group D2 and JK organisms were isolated from the groin more often than from the axilla or abdominal wall (Table 3). The mean of positive cultures by patient ranged from 1.5 to 1.86.

Discussion. The prevalences of coryneform groups D2 and JK among our patients were 44 and 53% for those admitted to the university hospital and chronic care institution, respectively. The prevalence of JK was 20%, lower than that reported by others, who did not investigate group D2 (4). On the other hand, a prevalence of the former microorganisms of 12 to 15.7% among healthy controls has been reported (3, 4), but it is difficult to make comparisons between the rates of colonization in hospitalized patients and healthy individuals since most studies are not age matched. Nevertheless, we did not find any relationship between rate of colonization and age.

Our data show very few differences between the rates of colonization by group D2 and JK organisms in patients admitted to the two different hospitals other than a trend toward a higher prevalence of group D2 at the chronic care institution (37 versus 25%).

Only 5 of the 97 patients colonized by group D2 or JK organisms harbored both microorganisms at the same time but at different skin sites. Thus, the presence of one of these organisms seems to exclude the other.

Our data suggest that immunosuppressed patients are not colonized more often by group D2 or JK organisms than immunocompetent patients, but the number of immunosuppressed patients was too low for a definite conclusion to be drawn. In addition, such a lack of correlation between immunosuppression and colonization by group JK organisms has been shown by others (3, 4). Nevertheless, clinical infections by JK organisms are more common in patients with malignancies or immunosuppression (3–5, 13, 14), since infections by D2 organisms are more frequent in patients with urological disorders (1, 9).

Corynebacterium group D2 was more prevalent in females than in males in both institutions, the differences being statistically significant. On the other hand, group JK was more prevalent in males than in females, although the differences were statistically significant only for patients admitted to the university hospital. This higher prevalence of JK among males has also been shown by others (3, 4).

TABLE 2. Prevalence of *Corynebacterium* groups D2 and JK on healthy skin of hospitalized patients

Population and organism(s)	No. of patients			Age (yr)		No. with immunosuppression	Length of hospitalization when surveyed (days)	
	Total	Male	Female	Range	Mean		Range	Mean
University hospital								
D2	25	4	21	23–88	61.3	2	1–62	15.8
JK[a]	20	14	6	13–78	60.9	6	1–56	16
D2 and/or JK[a]	44[b]	18	26	13–88	60.7	8	1–62	16.1
Chronic care institution								
D2	37	13	24	26–93	72.7	0	7–1,824	514.8
JK	20	12	8	35–87	68.9	1	7–1,458	564
D2 and/or JK	53[c]	23	30	26–93	70.0	1	7–1,824	537.8

[a] Data on group JK at the university hospital refer to 85 patients (with the first 15 patients, JK was not investigated).
[b] One patient harbored group D2 and JK organisms at the same time.
[c] Four patients harbored group D2 and JK organisms at the same time.

TABLE 3. Prevalence of *Corynebacterium* groups D2 and JK in hospitalized patients by skin site

Skin site	No. of patients with indicated organism			
	University hospital		Chronic care institution	
	D2	JK	D2	JK
Axilla	13	9	12	9
Groin	19	18	33	13
Abdominal wall	14	9	20	8

Considering patients from both hospitals as a whole, group D2 was also more prevalent in females than in males (43.3 versus 17.7%) and group JK was more prevalent in males than in females (32.1 versus 13.5%). All the differences were statistically significant. Accordingly, the rates of colonization by antibiotic-resistant corynebacteria (groups D2 and JK) were not different between the sexes (42.7 and 53.8% for males and females, respectively; $P = 0.1$). The former percentage may have been higher if group JK had been investigated in all males at the university hospital. As stated in Table 2, in the first 15 patients studied in the university hospital (all were males), group JK was not investigated.

Larson et al. (4) have shown that previous antimicrobial treatment does not correlate with the isolation of antibiotic-resistant corynebacteria from healthy skin. This parameter was not evaluated in our survey, since most of our patients were elderly with different underlying diseases which could compel such treatment. Nevertheless, most of our isolates were resistant to many antibiotics (2). The length of the hospitalization period did not significantly contribute to the prevalence of skin colonization by group D2 or JK organisms. It is possible, however, that in one ward at the chronic care institution a nosocomial spread of these microorganisms occurred, since a very high prevalence was found (92.8%).

The groin was the most frequent site of colonization by group D2 and JK organisms. Since the perineum has been another skin site more heavily colonized by JK organisms, it has been hypothesized that the antibiotic resistance of this organism may originate in the gastrointestinal tract and subsequently spread to skin sites (4).

In summary, our study showed that skin colonization by antibiotic-resistant corynebacteria (groups D2 and JK) in hospitalized patients is equally prevalent in males and females but that each group has a sex-related affinity.

LITERATURE CITED

1. **Aguado, J. M., C. Ponte, and F. Soriano.** 1987. Bacteriuria with a multiply resistant species of *Corynebacterium* (*Corynebacterium* group D2): an unnoticed cause of urinary tract infection. J. Infect. Dis. **156**:144–150.
2. **Fernández-Roblas, R., S. Prieto, M. Santamaría, C. Ponte, and F. Soriano.** 1987. Activity of nine antimicrobial agents against *Corynebacterium* group D2 strains isolated from clinical specimens and skin. Antimicrob. Agents Chemother. **31**:821–822.
3. **Gill, V. J., C. Manning, M. Lamson, P. Woltering, and P. A. Pizzo.** 1981. Antibiotic-resistant group JK bacteria in hospitals. J. Clin. Microbiol. **13**:472–477.
4. **Larson, E. L., K. J. McGinley, J. J. Leyden, M. E. Cooley, and G. H. Talbot.** 1986. Skin colonization with antibiotic-resistant (JK group) and antibiotic-sensitive lipophilic diphtheroids in hospitalized and normal adults. J. Infect. Dis. **153**:701–706.
5. **Lipsky, B. A., A. C. Goldberger, L. S. Tompkins, and J. J. Plorde.** 1982. Infections caused by nondiphtheria corynebacteria. Rev. Infect. Dis. **4**:1220–1235.
6. **McGinley, K. J., J. N. Labows, J. M. Zeckman, K. M. Nordstrom, G. F. Webster, and J. J. Leyden.** 1985. Pathogenic JK group corynebacteria and their similarity to human cutaneous lipophilic diphtheroids. J. Infect. Dis. **152**:801–806.
7. **Riley, P. S., D. G. Hollis, G. B. Utter, R. E. Weaver, and C. N. Baker.** 1979. Characterization and identification of 95 diphtheroid (group JK) cultures isolated from clinical specimens. J. Clin. Microbiol. **9**:418–424.
8. **Santamaría, M., C. Ponte, I. Wilhelmi, and F. Soriano.** 1985. Antimicrobial susceptibility of *Corynebacterium* group D2. Antimicrob. Agents Chemother. **28**:845–846.
9. **Soriano, F., C. Ponte, M. Santamaría, J. M. Aguado, I. Wilhelmi, R. Vela, and L. Cifuentes-Delatte.** 1985. *Corynebacterium* group D2 as a cause of alkaline-encrusted cystitis: report of four cases and characterization of the organisms. J. Clin. Microbiol. **21**:788–792.
10. **Soriano, F., C. Ponte, M. Santamaría, C. Castilla, and R. Fernández Roblas.** 1986. In vitro and in vivo study of stone formation by *Corynebacterium* group D2 (*Corynebacterium urealyticum*). J. Clin. Microbiol. **23**:691–694.
11. **Soriano, F., C. Ponte, M. Santamaría, and R. Fernández-Roblas.** 1987. Struvite crystal formation by *Corynebacterium* group D2 in human urine and its prevention by acetohydroxamic acid. Eur. Urol. **13**:271–273.
12. **Soriano, F., C. Ponte, M. Santamaría, A. Torres, and R. Fernández-Roblas.** 1987. Susceptibility of urinary isolates of *Corynebacterium* group D2 to fifteen antimicrobials and acetohydroxamic acid. J. Antimicrob. Chemother. **20**:349–355.
13. **Stamm, W. E., L. S. Tompkins, K. F. Wagner, G. W. Counts, E. D. Thomas, and J. D. Meyers.** 1979. Infection due to *Corynebacterium* species in marrow transplant patients. Ann. Intern. Med. **91**:167–173.
14. **Young, V. M., W. F. Meyers, M. R. Moody, and S. C. Schimpff.** 1981. The emergence of coryneform bacteria as a cause of nosocomial infections in compromised hosts. Am. J. Med. **70**: 646–650.