Microbiological Characteristics of Yeasts Isolated from Urinary Tracts of Intensive Care Unit Patients Undergoing Urinary Catheterization

N. FEBRÉ,1,2* V. SILVA,3,4 E. A. S. MEDEIROS,2 S. B. WEY,2 A. L. COLOMBO,5 AND O. FISCHMAN4

Escuela de Enfermería,1 and Microbiología—Micológia, Instituto de Ciencias Biomédicas,3 Facultad de Medicina, Universidad de Chile, Santiago, Chile, and Servicio de Prevención y Control de Infecciones Hospitalares, Hospital São Paulo e Departamento de Doenças Infecciosas e Parasitárias,2 Laboratorio Especial de Micología, Departamento de Doenças Infecciosas e Parasitárias,5 and Disciplina de Biologia Celular, Departamento de Microbiologia, Imunologia e Parasitologia,4 Universidade Federal de São Paulo, São Paulo, Brazil

Received 8 June 1998/Returned for modification 20 July 1998/Accepted 16 January 1999

We studied 70 intensive care unit patients to determine the incidence of nosocomial candiduria associated with indwelling urinary catheters and to assess microbiological characteristics of the yeasts. The yeasts were isolated, 13 of 17 in urine cultures and 4 of 17 in blood cultures, and colonization had occurred 3 days after the insertion of indwelling urinary catheters. For four strains the MICs of the antifungal drugs were high.

Nosocomial fungal infections are important causes of morbidity and mortality in patients admitted to intensive care units (ICU).

Urinary catheters have been held responsible as a cause of 80% of hospital urinary tract infections (UTI) (20). The surveillance data from the U.S. National Nosocomial Infections Surveillance system reported Candida albicans to be the fourth most common pathogen in UTI (11).

Candida spp. make up part of the human biota, and their qualitative isolation from urine cultures alone does not reveal evidence of infection (6). The concept of hospital candiduria would involve the development of UTI caused by Candida spp., with a culture of ≥10^5 CFU/ml on a specimen collected at least 72 h after hospital admission and a previous Candida spp.-negative culture (7, 16). Nevertheless, the Centers for Disease Control and Prevention offered a clear definition of bacterial UTI, but the subject remains controversial as far as yeasts are concerned (4).

The objective of this investigation was to check prospectively the incidence of urinary catheter-associated hospital candiduria and to evaluate the microbiological characteristics of the yeasts isolated from ICU patients with indwelling urinary catheters.

From June 1995 through January 1996 all adult patients admitted consecutively to the ICU of the Hospital São Paulo and undergoing urethral catheterization with negative urine and blood cultures at the time of admission were investigated. All patients who presented positive yeast urine cultures 72 h after the insertion of a urinary catheter were considered in this investigation. Patients who did not present positive yeast urine cultures during their ICU stays were considered the control group. Patients with previous histories of repeated urinary infections, with indwelling urinary catheters of uncertain origin and uncertain date of insertion, and those with positive fungal urine cultures during the first 24 h of catheterization were excluded (7, 15).

Urine, blood, and vaginal secretion samples were collected systematically upon admission and after each 72-h interval during the ICU stay of the patient. Final samples were collected 48 h after ICU discharge.

Blood cultures were incubated in the semiautomatized Bactec system (Becton Dickinson). The processing of blood, urine, and vaginal secretion specimens and the identification of isolated yeasts were carried out according to standard methods (18). Yeast profiles of susceptibility to antifungal agents were assessed by the means of broth microdilution (10). Results of doubtful readings or results with samples for which there were

TABLE 1. Distribution of urine culture results according to sex of patients who underwent urinary catheterization and were admitted to the Hospital São Paulo ICU

<table>
<thead>
<tr>
<th>Urine culture</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>8 (30.8)</td>
<td>5 (11.4)</td>
<td>13 (18.6)</td>
</tr>
<tr>
<td>Negative</td>
<td>18 (69.2)</td>
<td>39 (88.6)</td>
<td>57 (81.4)</td>
</tr>
<tr>
<td>Total</td>
<td>26 (100.0)</td>
<td>44 (100.0)</td>
<td>70 (100.0)</td>
</tr>
</tbody>
</table>

* RR = 1.95; CL (95%) = 1.1 to 3.46; P = 0.04.

* Corresponding author. Mailing address: Escuela de Enfermería, Facultad de Medicina, Universidad de Chile, Condell 303, Providencia, Santiago, Chile. Phone: 56-2-2047848, ext. 15. Fax: 56-2-2047848, ext. 42. E-mail: nfebrec@machimed.uchile.cl.

TABLE 2. Distribution of isolated yeast species in urine specimens from 17 patients admitted to the Hospital São Paulo ICU

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of specimens</th>
<th>% of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. albicans</td>
<td>6</td>
<td>46.15</td>
</tr>
<tr>
<td>C. glabrata</td>
<td>4</td>
<td>30.77</td>
</tr>
<tr>
<td>C. krusei</td>
<td>1</td>
<td>7.70</td>
</tr>
<tr>
<td>T. inkin</td>
<td>1</td>
<td>7.70</td>
</tr>
<tr>
<td>T. ovoides</td>
<td>1</td>
<td>7.70</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100.00</td>
</tr>
</tbody>
</table>

56-2-1137/99/$04.00+0 Copyright © 1999, American Society for Microbiology. All Rights Reserved.
very high MICs were confirmed by the macrodilution technique (9).

In our study, 70 adult patients were evaluated. The investigation revealed a median of 70 years of age for patients with urine cultures positive for yeasts; the calculated mean was 65 years of age, which is in agreement with the work of Hamory and Wenzel (7).

The presence of yeasts was observed in 18.6% of urine specimens from patients with indwelling urinary catheters (Table 1). Values between 11 and 25.7% were reported by other authors (7, 15, 16). A total of 8 of 26 women (30.8%) presented yeast isolation, whereas in the 44 male subjects the percentage was 11.4% (relative risk [RR] = 1.95; confidence level [CL] 95% = 1.1 to 3.46; \( P = 0.04 \)), in accordance with the work of Gubbins et al. (6). We found that five of the eight patients with initial positive vaginal secretions later showed the presence of the same yeast species in their urine. The yeast ascent from the female genitourinary tract to the urinary tract may be influenced by anatomofunctional factors related to that sex and explains the greater incidence of candiduria in women (5, 8).

The candidemia incidence of 5.7% found in our investigation does not differ from that reported by other authors (2, 21). C. albicans, Candida parapsilosis, Candida tropicalis, and Candida famata were isolated from each patient. According to some researchers, candiduria occurs mainly through a descending route (6). Nevertheless, the four patients who presented candidemia did not have positive urine cultures during a period of up to eight follow-up days.

Several researchers have emphasized the role of species other than C. albicans as emergent pathogens in UTI (6, 12, 14). We isolated C. albicans (46.15%) most often, followed by Candida glabrata (30.77%) and Candida krusei (7.7%), from urine specimens (Table 2), which is in agreement with data reported by other authors (3, 5, 18). The presence of organisms from the genus Trichosporon in the urinary tract has been scarcely reported in the literature (1, 19). It is important to stress the isolation of Trichosporon inkin (7.7%) in the urine of a 48-year-old male patient with multiple injuries and Trichosporon ovoides (7.7%) in the urine culture of a 68-year-old diabetic woman during the aneurysmectomy postoperative period.

The specific identification of yeasts provides important help in the choice of treatment, because C. glabrata and C. krusei are naturally resistant to fluconazole (13, 17). From blood culture specimens one C. albicans strain for which the fluconazole MIC was 64 \( \mu \)g/ml was isolated; from three urine samples we identified one C. krusei strain for which the fluconazole MIC was 64 \( \mu \)g/ml and two Trichosporon isolates for which MICs of all tested drugs were high (Table 3).

The duration of catheterization is an important risk factor (20). Time intervals of 6, 7, or even 12 days have been reported by different authors for the identification of yeasts after the insertion of urinary catheters (5, 6). Our findings show that 9 of 13 patients undergoing catheterization and with positive urine cultures presented yeasts in their urine 72 h after the insertion of urinary catheters.

Urinary catheterization may cause candiduria, with the absence or presence of the disease suggesting that colony counts may reflect catheter colonization (6). Nevertheless, high counts of CFU/ml obtained from urinary catheterized patients, would represent the amount of yeasts in the bladder and not necessarily catheter colonization (5). In our investigation we found that initial urine cultures with values lower than 20,000 CFU/ml (four patients) became negative without medical treatment. On the other hand, patients with isolation values higher than 20,000 CFU/ml received antifungal therapy. We should stress that the drug was administered without previous knowledge of the results of the mycological examination.

The natural history of urinary tract colonization or infection in patients with indwelling urinary catheters has not been well defined yet (5, 6). According to our findings, which are partially in agreement with data reported in the literature, surveillance urine cultures should be carried out in patients who present risk factors such as previous antibiotic therapy, Foley catheterization, or immunocompromised state or who are female ICU patients. If a yeast count of \( \geq 20,000 \) CFU/ml is obtained, a new urine sample should be collected in the following 72 h, in order to evaluate the therapy conduct.

### REFERENCES

method for broth dilution antifungal susceptibility testing of yeast. Proposed
standard M27-P. National Committee for Clinical Laboratory Standards,
Villanova, Pa.
method for broth dilution antifungal susceptibility testing of yeast. Tentative
standard M27-T. National Committee for Clinical Laboratory Standards,
Wayne, Pa.
mal Infections Surveillance (NNIS) report, data summary from October
291.
and management, p. 103–124. In M. D. Richardson and D. W. Warnock
Williams, New York, N.Y.
Risk factors for hospital-acquired candidemia. A matched case-control