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ORIGINAL ARTICLE

An epidemiologic analysis of Candida spp. urinary infections in intensive care unit

Uma análise epidemiológica das infecções urinárias por Candida spp. em unidade de terapia intensiva

Un análisis epidemiológico de las infecciones urinarias por Candida spp. en la unidad de cuidados intensivos

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ABSTRACT

Background and objectives: The finding of *Candida* species in urine is an usual finding and is called candiduria. There is an increase in the frequency of urinary tract infections (UTI) caused by *Candida* especially in critically ill patients. This study aimed to determine the epidemiological, clinical, and mycological characteristics of *Candida* urinary infections in intensive care unit (ICU) and antifungal susceptibilities. **Methods:** Urine cultures of 394 ICU patients with clinical suspicion of UTI were evaluated. After 24-48 hours of incubation, colonies appeared to grow as yeast, were morphologically examined by Gram staining. *Candida* strains that grew $10^4 \geq$ CFU/mL in urine cultures were accepted as candiduria. The susceptibilities of the *Candida* strains to amphotericin B, itraconazole, fluconazole, voriconazole, flucytosine, and caspofungin were investigated with broth microdilution method. **Results:** The distribution of the isolated 100 urinary *Candida* strains were as, 54 *Candida albicans*, 34 *C. glabrata*, 7 *C. tropicalis*, 2 *C. kefyr*, 2 *C. lusitaniae*, and 1 as *C. parapsilosis*. Among 100 *Candida* species isolated in our study susceptibility rates of amphotericin B, flucytosine, caspofungin, fluconazole, itraconazole, and voriconazole were 100%, 100%, 91%, 23%, 13%, 25.8%, respectively. **Conclusion:** Accurate identification of *Candida* spp., as well as the investigating the antifungal susceptibility, will be beneficial in terms of the effectiveness of the treatment and the prevention of resistance development.

Keywords: *Candida. Urinary tract infection. Fluconazole. Amphotericin B.*

RESUMO

Justificativa e objetivos: O achado de espécies de *Candida* na urina é um achado comum e é chamado de candidúria. Há um aumento na frequência de infecções do trato urinário (ITU) causadas por *Candida*, principalmente em pacientes críticos. Este estudo teve como objetivo determinar as características epidemiológicas, clínicas

e micológicas das infecções urinárias por *Candida* em unidade de terapia intensiva (UTI) e a susceptibilidade aos antifúngicos. **Métodos:** Foram avaliadas culturas de urina de 394 pacientes de UTI com suspeita clínica de ITU. Após 24-48 horas de incubação, as colônias pareceram crescer como leveduras, foram morfologicamente examinadas por coloração de Gram. As cepas de *Candida* que cresceram ≥10^4 UFC/mL em culturas de urina foram aceitas como candidúria. As suscetibilidades das cepas de *Candida* à anfotericina B, itraconazol, fluconazol, voriconazol, flucitosina e caspofungina foram investigadas com o método de microdiluição em caldo. **Resultados:** A distribuição das cepas 100 isoladas de *Candida* urinária foi de 54 *Candida albicans*, 34 *C. glabrata*, 7 *C. tropicalis*, 2 *C. kefyr*, 2 *C. lusitaniae* e 1 como *C. parapsilosis*. Entre 100 espécies de *Candida* isoladas em nosso estudo, as taxas de susceptibilidade de anfotericina B, flucitosina, caspofungina, fluconazol, itraconazol e voriconazol foram de 100%, 100%, 91%, 23%, 13%, 25,8%, respectivamente. **Conclusão:** A identificação precisa de *Candida* spp., bem como a investigação da susceptibilidade aos antifúngicos, será benéfica em termos de eficácia do tratamento e prevenção do desenvolvimento de resistência.

Palavras chave: *Candida. Infecções urinárias. Fluconazol. Anfotericina B*

RESUMEN

Justificación y objetivos: El hallazgo de especies de *Candida* en la orina es un hallazgo habitual y se denomina candiduria. Hay un aumento en la frecuencia de infecciones del tracto urinario (ITU) causadas por *Candida*, especialmente en pacientes críticamente enfermos. Este estudio tuvo como objetivo determinar las características epidemiológicas, clínicas y micológicas de las infecciones urinarias por *Candida* en la unidad de cuidados intensivos (UCI) y la susceptibilidad antifúngica. **Métodos:** Se evaluaron urocultivos de 394 pacientes de UCI con sospecha clínica de ITU. Después de 24-48 horas de incubación, las colonias parecían crecer como levadura, se examinaron morfológicamente mediante tinción de Gram. Las cepas de *Candida* que crecieron 104 ≥ UFC / ml en urocultivos se aceptaron como candiduria. Las susceptibilidades de las cepas de Candida a la anfotericina B, itraconazol, fluconazol, voriconazol, flucitosina y caspofungina se investigaron con el método de microdilución en caldo. **Resultados:** La distribución de las cepas 100 urinarias aisladas de *Candida* fue de, 54 *C. albicans*, 34 *C. glabrata*, 7 *C. tropicalis*, 2 *C. kefyr*, 2 *C. lusitaniae* y 1 como *C. parapsilosis*. Entre las 100 especies de *Candida* aisladas en nuestro estudio, las tasas de susceptibilidad de anfotericina B, flucitosina, caspofungina, fluconazol, itraconazol y voriconazol fueron 100%, 100%, 91%, 23%, 13%, 25,8%, respectivamente. **Conclusión:** La identificación precisa de *Candida* spp., así como la investigación de la susceptibilidad antifúngica, será beneficiosa en términos de la eficacia del tratamiento y la prevención del desarrollo de resistencias.

Palabras clave: *Candida. Infecciones urinarias. Fluconazol. Anfotericina B*

INTRODUCTION

Candida species are members of microbioata at various sites in the human body.[1] However, they are capable of colonizing mucocutaneous tissues via attaching to the superficial mucosal cells and are accepted as opportunistic pathogens.[2] The finding of *Candida* species in urine is a usual clinical situation and is called candiduria.[3] In urine cultures, *Candida albicans* and non-*albicans* species are predominantly isolated among fungi, and in the last two decades, there was a remarkable increase in urinary tract infections (UTIs) caused by opportunistic fungi, especially among hospitalized patients which create considerable public health predicaments.[1,4] Also, there is an increase in the frequency of UTIs caused by fungi, especially *Candida* species in critically ill patients.[5]

Candida species may cause UTIs via both antegrade pathway by entering the upper urinary tract from the systemic circulation and retrograde pathway by ascending the urinary tract from a colonization site around the urethra.[6] Several reports indicate that *Candida* species are responsible for at least 10-15% of nosocomial UTIs.[3,7] UTIs caused by *Candida* is an emergent problematic issue for immunocompromised and critically ill patients, among the hospitalized patients, candiduria is a frequent finding particularly in intensive care units (ICUs) and in adult surgical ICUs candiduria more frequently go along with UTIs.[3,7-10]

There are well defined independent risk factors for candiduria and *Candida* UTIs including; age >65 years, female sex, prolonged hospitalization, ICU admission, diabetes mellitus, disturbance in microbiome caused by broad-spectrum antimicrobials, female sex, total parenteral nutrition, bladder dysfunction, congenital abnormalities of the urinary tract, renal transplantation, urinary stasis, nephrolithiasis, concomitant bacteriuria, genitourinary tuberculosis, neutropenia, urinary tract instrumentation, chronic renal failure, mechanical ventilation and immunosuppressive therapy.[2,3,5,8,9-11]

Even though *C. albicans* is often reported as the predominant species responsible for UTIs, all common *Candida* species can cause UTIs, and non-*albicans* species emerge with better adaptation to the urinary tract system because many studies worldwide stating that half of the candiduria isolates are non-albicans.[7-9,12] Frequent use of antifungal prophylaxis and treatment results in infections with non-*albicans* species showing resistance to antifungals.[13] An increase in non-*albicans* species appears

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as a significant problem due to decreased susceptibility of non-albicans species to antifungals, which may result in complexities or failures in the management of UTIs.[14] This study aimed to determine the epidemiological, clinical, and mycological characteristics of *Candida* urinary infections in intensive care unit (ICU) patients and antifungal susceptibilities of *Candida* species.

METHODS

In our study, urine cultures of ICU patients were investigated duplicate samples and patients who were taking prior antifungal therapy were excluded. A total of 394 nonrepetitive patients with clinical suspicion of UTIs from anesthesiology and reanimation ICU (50.7%) and internal diseases ICU (49.3%) were evaluated. Since urinary catheterization is a standard practice in ICUs, all patients included in the study had an indwelling urinary catheter. The demographic information and laboratory findings of the patients including age, sex, length of stay, existence of concomitant bacteriuria, existence of concurrent candidemia and average days for detection of candiduria after admittance to th ICU were recorded. Urine samples were transferred with sterile urine containers and inoculated onto Sabouraud Dextrose Agar (SDA; Salubris, Turkey) medium. After 24-48 hours of incubation at 25 °C and 37 °C, colonies appeared to grow as yeast, were morphologically examined by Gram staining. *Candida* strains that grew $10^4 \geq$ CFU/mL in urine cultures were accepted as candiduria and included in our study.[15,16]

For the identification of *Candida* species an automated identification system Phoenix (Becton Dickinson, Germany) and chromogenic agar (Chromagar; Salubris, Turkey), as well as classical methods like germ-tube formation was used. Color change of colonies at chromogenic agar was observed after 48 hours of incubation; *C. albicans* was observed as green, *C. tropicalis* as blue, *C. glabrata,* and *C. kefyr* as pink-purple

The susceptibilities of the *Candida* strains to amphotericin B, itraconazole, fluconazole, voriconazole, flucytosine, and caspofungin were investigated using the reference broth microdilution method in the Clinical and Laboratory Standards Institute (CLSI) M27-A3, M27-S3, and M27-S4.[17-19] For broth microdilution susceptibility experiments, caspofungin (Sigma, China), amphotericin B (Sigma, Israel), fluconazole (Sigma, USA), flucytosine (Sigma, UK), voriconazole (Sigma, USA), and itraconazole (Sigma, USA) were used as antifungals. Distilled water was used for fluconazole and flucytosine, DMSO (dimethyl sulfoxide) (Merck, USA) was used for water-insoluble caspofungin, amphotericin B, voriconazole, and itraconazole as a solvent. Stock solutions were prepared at 1280 µg / mL for fluconazole, 1600 µg / mL for amphotericin B, 1600 µg / mL for voriconazole, 1600 µg / mL for itraconazole, 1600 µg / mL for flucytosine, and 640 µg / mL for caspofungin. Prepared antifungal stock solutions were passed through a membrane filter, divided into 1 mL volumes, placed in sterile Eppendorf tubes, and stored at -80 ° C until use. Amphotericin B was coated, protected from light.

An inoculum concentration adjusted to $1.5\times10^3\pm1.0\times10^3$ cells/ml with using RPMI 1640 medium (Sigma, USA), were tested with two-folds increasing antifungal concentrations of amphotericin B (0.0313-16 µg/mL), flucytosine (0.125-64 µg/mL), itraconazole (0.0313-16 µg/mL), fluconazole (0.125-64 µg/mL), voriconazole (0.0313 - 16 µg/mL), caspofungin (0.015-8 µg/mL) by broth microdilution method. After incubation at 35 °C for 48 h (24 hours for caspofungin), minimum inhibitory concentrations (MICs) were defined as the lowest concentration that inhibited visual fungal growth compared with the drug-free controls. *C. parapsilosis* ATCC 22019 and *C. krusei* ATCC 6258 strains were used for control.

Breakpoints for antifungal susceptibility were evaluated according to CLSI guidelines but, CLSI has not determined breakpoints for amphotericin.[19] The isolates inhibited by amphotericin B at ≤1 µg /ml were considered susceptible, resistant isolates were defined as isolates with MIC >1 µg/ml. Also, since there is no new update in M27-S4 for *C. kefyr*, the values in M27-S3 were taken into consideration while evaluating the MIC breakpoints. [18, 19] Also for *C. lusitaniae*, since there is no update for M27-S4 fluconazole and voriconazole, the MIC breakpoints specified in M27-S3 were taken into consideration.

SPSS 16.0 (Statistical Package for Social Sciences) Package program was used for the analysis of the data obtained from the study. Mean, standard deviation, and percentage distributions were given as descriptive statistics. In addition, the Chi-Square test was used for the comparison of non-numerical variables. Mann Whitney-U test was used to compare binary variables with numerical data. The results obtained were evaluated at the 95% ($P < 0.05$) significance level. In order to carry out this study, ethics committee approval was obtained from Gaziantep University Clinical Research Ethics Committee (Code:2016/298).

RESULTS

Urine samples from 394 ICU patients were examined; there was candiduria in 54 (13.7%) patients, candiduria and concomitant bacteriuria in 46 (11.6%) patients, bacteriuria in 69 (17.5%) patients, and 235 (59.6%) patients had negative urine cultures. A total of 100 *Candida* strains were evaluated. The distribution of the isolated urinary *Candida* strains were as, 54 *C. albicans*, 34 *C. glabrata*, 7 *C. tropicalis*, 2 *C. kefyr*, 2 *C. lusitaniae*, and 1 as *C. parapsilosis*. Concurrent candidemia was detected in 14 of patients with candiduria. The distribution of *Candida* species isolated from blood cultures was 10 (71.4%) *C. albicans*, 2 (14.2%) *C. parapsilosis*, 1 (7.1%) *C. glabrata*, and 1 (7.1%) *C. lusitaniae*.

Determined by broth microdilution; 91 *Candida* species were susceptible to caspofungin, 8 were moderately susceptible, and 1 was resistant, 23 *Candida* species were susceptible to fluconazole, 37 were dose-related susceptible, and 40 were resistant, 13 *Candida* species were susceptible to itraconazole, 18 were dose-dependent susceptible, and 69 were resistant. There were 17

(25.8%) voriconazole susceptible strains, 13 dose-dependent susceptible (19.7%) strains, and 36 (54.5%) resistant *Candida* strains (*C. glabrata* not included due to CLSI statement: current data are insufficient to demonstrate a correlation between *in vitro* susceptibility testing and clinical outcome). Among the 100 *Candida* strains examined, resistant strains against amphotericin B (≥2 µg/mL) and flucytosine (≥32 µg/mL) were not detected. MIC range, $MIC_{50,}$ and MIC_{90} values of antifungal drugs for *Candida* species are given in Table 1. Also, detailed antifungal susceptibility results of different *Candida* species were given in Table 2.

Table 1. MIC ranges, MIC_{50} and MIC_{90} values of antifungals for different *Candida* species.

Species (n)	Antifungal	MIC range (µg/mL)	MIC_{50} (µg/mL)	MIC_{90} (µg/mL)
C. albicans	Amphotericin B	0.125-1	0.5	1
(54)	Itraconazole	0.06-16	2	16
	Voriconazole	0.03-16	2	16
	Caspofungin	0.015-0.5	0.03	0.25
	Fluconazole	0.125-64	4	64
	Flucytosine	0.125-2	0.125	0.5
C. glabrata	Amphotericin B	0.125-1	1	1
(34)	Itraconazole	0.03-16	8	16
	Voriconazole	0.03-16	1	16
	Caspofungin	0.015-0.5	0.03	0.25
	Fluconazole	0.125-64	4	64
	Flucytosine	0.125-0.5	0.125	0.25
C. tropicalis	Amphotericin B	0.5-1	0.5	1
(7)	Itraconazole	0.06-16	0.125	16
	Voriconazole	0.03-16	0.125	1
	Caspofungin	0.03-0.125	0.06	0.06
	Fluconazole	1-32	8	32
	Flucytosine	0.125-0.5	0.125	0.5
C. kefyr	Amphotericin B	0.5-1	0.5	1
(2)	Itraconazole	1-16	1	16
	Voriconazole	1	1	1
	Caspofungin	0.03-0.125	0.03	0.125
	Fluconazole	0.25-64	0.25	64
	Flucytosine	0.125	0.125	0.125
C. lusitaniae	Amphotericin B	0.25-1	0.25	1
(2)	Itraconazole	0.06-1	0.06	1
	Voriconazole	0.5-16	0.5	16
	Caspofungin	0.06	0.06	0.06
	Fluconazole	8-16	8	16
	Flucytosine	0.125	0.125	0.125
C. parapsilosis	Amphotericin B	0.5	0.5	0.5
(1)	Itraconazole	0.06	0.06	0.06
	Voriconazole	0.06	0.06	0.06
	Caspofungin	0.25	0.25	0.25
	Fluconazole	8	8	8
	Flucytosine	0.5	0.5	0.5

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Table 2. Antifungal susceptibility results of different *Candida* species.

Antifungal		*C. albicans*	*C. glabrata*	*C. tropicalis*	*C. lusitaniae*	*C. kefyr*	*C. parapsilosis*
Caspofungin†	S	50(92.6%)	29(85.3%)	7(100%)	2 (100%)	2(100%)	1 (100%)
	I	4 (7.4%)	4 (11.8%)	-	-	-	-
	R	-	1 (2.9%)	-	-	-	-
Fluconazole†	S	18(33.3%)	-	3(42.9%)	1 (50%)	1 (50%)	-
	I	11(20.4%)	25(73.5%)	-	1 (50%)	-	-
	R	25(46.3%)	9 (26.5%)	4(57.1%)	-	1 (50%)	1 (100%)
Voriconazole†,‡	S	9 (16.7%)	17(97.6%)	4(57.1%)	1 (50%)	2(100%)	1 (100%)
	I	12(22.2%)	1	1(14.3%)	-	-	-
	R	33(61.1%)	16 (2.4%)	2(28.6%)	1 (50%)	-	-
Itraconazole	S	4(7.4%)	4 (11.8%)	3(42.9%)	1 (50%)	-	1 (100%)
	I	12(22.2%)	5 (14.7%)	1(14.2%)	-	-	-
	R	38(70.4%)	25(73.5%)	3(42.9%)	1 (50%)	2(100%)	-
Flucytosine	S	54 (100%)	34 (100%)	7 (100%)	2 (100%)	2(100%)	1 (100%)
	I	-	-	-	-	-	-
	R	-	-	-	-	-	-
Amphotericin B	S	54 (100%)	34 (100%)	7 (100%)	2 (100%)	2(100%)	1 (100%)
	I	-	-	-	-	-	-
	R	-	-	-	-	-	-
Total		54 (54%)	34 (37%)	7 (7%)	2 (2%)	2 (2%)	1 (1%)

Abbreviations: S,susceptible; I,intermediate/susceptible-dose dependent; R,resistant.
†There is no CLSI defined breakpoints for C. kefyr and C. lusitaniae, breakpoints for C. tropicalis was applied
‡There is no CLSI defined voriconazole breakpoints for C.glabrata, breakpoints for C. krusei was applied

In our study, 60 (60%) of the patients with candiduria were female and 40 (40%) were male. A significant difference was found between the two groups in terms of sex distribution (p=0.046). When *Candida* species were analyzed according to sex, *C. albicans* was higher (53.7%) among males and non-*albicans* species were higher (58.3%) among females. Non-albicans species were isolated more frequently in females and a statistically significant difference was found (p=0.002). Of the 100 patients whose *Candida* strains were isolated, 9 were in the age range of 20-40, 16 were 41-60, and 75 were 61 and over. The length of stay of the patients in the ICUs was varying between 6 and 120 days (mean 33.8 days). After admittance to ICU, candiduria was detected (mean 9.7 days) within 1-9 days in 64 patients, 10-19 days in 23 patients, 20-29 days in 8 patients and >30 days in 22 patients. While the mortality rate was 41.1% among patients included in our study (n:349), the overall mortality rate among patients with candiduria was 69%, and among patients with both candiduria and candidemia was 92.8%. There was a significant difference in mortality rate between patients with candiduria and without candiduria (p <0.001). No significant difference was found between the causative agent of candiduria and the mortality rate.

DISCUSSION

The detection of candiduria manifests as a diagnostic and therapeutic challenge for all levels of health care settings and may be frustrating for physicians from primary care or infectious diseases, along with intensive medicine and surgery.[6] Urinary *Candida* may be related to a number of conditions ranging from sample contamination to UTIs, including invasive candidiasis, therefore, require detailed analysis.[1,6] Obtaining new urine samples and confirming whether candiduria persists, can usually help for differentiation of contamination from colonization or UTI.[2] If there is growth in the second culture repeated, but the patient is asymptomatic, predisposing factors should be reviewed, the urinary catheter should be removed, and antibiotic therapy should be terminated.[5] Urinary tract imaging is recommended in patients with diabetes mellitus and patients with known urinary tract abnormalities, it may be guiding for appropriate treatment.[5]

In our study, female sex and advanced age were detected as risk factors for the development of candiduria. Although females are twice as likely to develop nosocomial candiduria when compared to males, possibly due to the anatomical differences of their genitals and vaginal colonization, females with candiduria was linked to a reduced risk of candidemia when compared to males.[20] *Candida* species are more common in the urine of the elderly, especially after broad-spectrum antibiotic treatments, advanced age, normal physical changes, and/or various metabolic disorders or neoplastic diseases that cause disruption of the mucosal and cutaneous barriers and make the person vulnerable to *Candida* infections.[21] Interestingly we did not find a correlation between long-stay in ICU and candiduria while 64% of our patients develop candiduria in 9 days after admittance to ICU, in a similar study from France, the time between admission to the ICU and the development of candiduria was reported as 17.2±1.1 days.[4]

There are no defined standard diagnostic criteria for diagnosis of *Candida* UTIs and their differention of

from asymptomatic candiduria, and differentiation of upper from lower UTIs.[22] Also, there is no consensus in diagnostic evaluation colony counts(CFU/ml) and urine collection technique for neonatal candiduria unlike in bacteriuria.[11] Although the clinical significance of candiduria is still contradictory, various researchers suggest that colony counts greater than 10^3–10^4CFU/mL are more likely related to primary or disseminated candidiasis, rather than sample contamination or colonization.[16]

Candiduria frequency among ICU patients increased in recent years, especially among patients requiring urinary instrumentation or receiving broad-spectrum antibiotics and risk of occurence is as high as 22.89% in ICU patients.[23] The finding of *Candida* in the urinary samples is associated with higher mortality, particularly in ICU patients with accompanying comorbidities. However, higher mortality rates in patients with candiduria are not often directly attributable to invasive candidiasis. Nevertheless, candiduria may be an indicator of severe underlying diseases.[7] In a clinical study in-hospital mortality was 48.8% in patients with candiduria compared to 36.6% in those without candiduria (p <0.001), they also found significant differences for ICU mortality (38.% vs. 28.1%, p <0.001).8 Researchers found, candiduria detected at any time in the surgical ICU was independently associated with mortality.[24] Our study also revealed candiduria as an independent risk factor for mortality (p <0.001). The incidence of concurrent candidemia is infrequent and has been encountered in 1-8% of patients with candiduria, even so, ICU patients constitute the high-risk group.[10] Our results showing 14% candiduria with concurrent candidemia in ICU patients also indicate physicians should be more alarmed about invasive candidiasis in critically ill patients with candiduria. Long hospital-stay and malignancy are predictors for developing candidemia in patients with candiduria; however, the patient characteristics linked to concomitant candidemia in the presence of candiduria remain unknown.[20]

Management of candiduria is still contradictory because the finding of *Candida* spp. in urinary specimens may indicate asymptomatic infection, lower UTI, upper UTI with a potential for ascending pyelonephritis, renal candidiasis leading to invasive and disseminated candidiasis, which not only results in considerable morbidity and mortality but also prolonged hospitalization and growing cost.[2] Candiduria may be an indicator of disseminated candidiasis in neutropenic, low birth weight infants, patients undergoing urological procedures, and renal transplant recipients patient groups.[5] Candiduria in critically ill patients whether symptomatic or not should initially be considered as a clue of disseminated candidiasis and antifungal drug prophylaxis appears to be warranted since the kidney is affected by disseminated candidiasis in 80% of patients.[2] Detection of candiduria may be the only evidence that the patient has a serious infection. In these patients, systemic therapy with fluconazole or another azole derivative is recommended. An echinocandin, such as caspofungin, is selected if the patient has had recent exposure to fluconazole, which is the drug of choice.[5] In the treatment of cystitis and pyelonephritis, oral fluconazole is used in susceptible strains, and flucytosine and amphotericin B are used in those with fluconazole resistance. Bladder irrigation with amphotericin B may be beneficial in cystitis caused by fluconazole-resistant strains such as *C. glabrata* and *C. krusei*.[5] Voriconazole is stated as an effective antifungal that can be used in isolates resistant to fluconazole. However, a significant portion of fluconazole-resistant *Candida* isolates become resistant to voriconazole as well as itraconazole as a result of cross-resistance.[17] The most important features of caspofungin are that it is effective against azole and amphotericin B resistant *Candida* strains. Since there is no cross-resistance between azole antifungals, caspofungin can be a good option for *Candida* species resistant to azole antifungals.[1]

Although *C. albicans* is the most prevalent species reported in urine culture, other species such as *C. glabrata, C. parapsilosis, C. tropicalis, C. kefyr, C. lusitanae, C. guilhermondi,* and *C. dubliniensis* can also be isolated.[1] The distribution of causative agents of *Candida* UTIs is shifting, non-albicans species are detected in more than half of the urinary samples, which also bring along antifungal resistance issues. [7] These non-albicans *Candida* may not only show better adaptation to the kidney and collecting system but also more challenging to eradicate than *C. albicans*.[9] The detection of candiduria in an ICU patient should be regarded as an indicator of poor prognosis and the accurate identification of *Candida* spp., as well as the investigating the antifungal susceptibility, will be beneficial in terms of the effectiveness of the treatment and the prevention of resistance development.

DECLARATIONS OF INTEREST

None.

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AUTHOR'S CONTRIBUTION

Fahriye Ekşi and **Süleyman Ganidağlı** was responsible for the organization and coordination and was the chief investigator. **Ban Ali Hassan, Mehmet Erinmez, Berna Kaya Uğur**, and **Hamit Yıldız** performed the data analysis and developed the trial design. **Mehmet Erinmez** and **Fahriye Ekşi** critically revised the manuscript for important intellectual content. All authors contributed to the writing of the final manuscript.