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Research Article

Distribution of *Candida Species* Isolated from Blood Cultures Over a Period of Four Years

Sadik Akgun,[1] Hakan Sezgin Sayiner,[2] Sumeyra Kayali[1]

[1]Department of Medical Microbiology, Adiyaman University, Faculty of Medicine, Adiyaman, Turkey
[2]Department of Infectious Diseases and Clinical Microbiology, Adiyaman University, Faculty of Medicine, Adiyaman, Turkey

Abstract

Objectives: Candida, which is an opportunistic pathogen, is becoming a cause of significant morbidity and mortality due to the infection it can cause, especially in patients at greater risk. The aim of the present study was to examine a total of 95 Candida isolates collected from blood cultures at a training and research hospital microbiology culture laboratory over approximately 4 years.

Methods: This study included 95 Candida samples grown in blood cultures at the microbiology laboratory between 2014 and 2017. The samples were first seeded with 5% sheep blood agar and eosin methylene blue agar media. Next, those identified as yeast using conventional methods were isolated with Sabouraud Dextrose Agar. Subsequently, the strain was identified using a fully automated culture-antibiogram device.

Results: Type distribution indicated that among the 95 Candida samples collected over 4 years, the most common strains were *C. albicans* (n=43; 45%) and *C. parapsilosis* (n=24; 25%), followed by *C. tropicalis* (n=14; 15%), *C. glabrata* (n=6; 6%), and C. kefyr (n=5; 5%).

Conclusion: According to these results, although there was an increase in the number of other *Candida species* observed, *C. albicans* remains the most important pathogen.

Keywords: Blood culture, *Candida albicans*, identification, yeast

Candida species are from fungi in the yeast structure and the number of species is about 200. Opportunistic pathogens such as yeasts are becoming the cause of significant morbidity and mortality, especially in patients at risk, due to the infections they cause.[1] Candida have recently been among the important pathogens due to opportunistic infections and nosocomial infections that they have caused in recent years.[2] *Candida species* are the 4th most frequent nosocomial bloodstream infections.[3, 4] Although the frequency of nonalbicans candida has increased in recent times, *Candida albicans* is the most common causative agent in candidemia.[5] Because of the different antifungal resistance profiles of *Candida species* and the widespread use of empirical antifungal, treatment planning according to the likely effect is especially important in cases where antifungal susceptibility test can not be performed.[6]

In our study; Candida strains recovered from blood cultures from patients in intensive care unit, were identified and their frequency and their changes within a period of about 4 years in these periods were examined.

Address for correspondence: Sadik Akgun, MD. Adiyaman Universitesi Tip Fakultesi Tibbi Mikrobiyoloji Anabilim Dali, Adiyaman, Turkey
Phone: +90 538 239 672 8 **E-mail:** sakgungizem@hotmail.com
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Methods

In the study, a total of 95 *Candida species* obtained from blood cultures were evaluated at the Training and Research Hospital, Medical Microbiology Culture Laboratory between January 2014 and September 2017. Five-ten ml. blood samples in bottles were placed into an automated incubation system (Bactec 9120, USA) using separate blood culture bottles (Bactec Ped Plus and Bactec-Plus aerobic, Becton-Dickinson, USA) for pediatric and adult patients. These blood samples were allowed to stand in an incubator for 24 hours in a 5-day incubation period, with positive signaling as a reproductive sign, on 5% Sheep Blood Agar (SBA) and Eosin Methylene Blue (EMB) Agar media. After that, those strains determined as yeast by conventional methods (Direct Microscopic examination, Gram staining and Germ Tube test etc.) plated on Sabouraud Dextrose Agar (SDA) medium, and allowed for 24 hours in an incubator. Later, species-level identification of these fungal isolates was carried out using a fully automated culture-antibiogram device (Phoenix 100, BD, USA) and using by its approprate kit (Yeast ID, BD, USA).

In our study, statistical analyses were performed in a retrospective cohort analysis using the SPSS 15.0 Program. Our results of continuous data analyses were given as minimum, maximum, median, and mean values, and the results of categorical (intermittent) variables as frequency and percentage.

Ethical Committee approval and patient consent are not required since the patient does not share any information about his or her personal information or illnesses.

Results

Candida species were detected in a total of 95 blood cultures. Of these, 80 (84.2%) were taken from the patients in the intensive care units and 15 (15.7%) were in the blood cultures of the other services.

When we look at the reproductive status according to years; in 2014, a total of 26 cases of yeast were detected, 22 in intensive care unit (ICU), 4 in other clinics. The number of species distributions: 11 (42.3%); for *C. albicans*, 7 (26.9%); for *C. parapsilosis*, 3 (11.5%); for *C. tropicalis*, 3 (11.5%); for *C. glabrata*, and 1 (3.8%) *C. dubliniensis* and *C. kefyr*, respectively.

In 2015, a total of 24 cases of yeast were detected, 22 in ICU, 2 in other clinics. The number of species distributions: 11 (45.8%); for *C. albicans*, 7 (29.1%); for *C. parapsilosis*, 4 (16.6%); for *C. tropicalis*, and 1 (4.1%); *C. glabrata* and *C. kefyr*, respectively.

In 2016, a total of 29 cases of yeast were detected, 22 in ICU, 7 in other clinics. The number of species distributions:

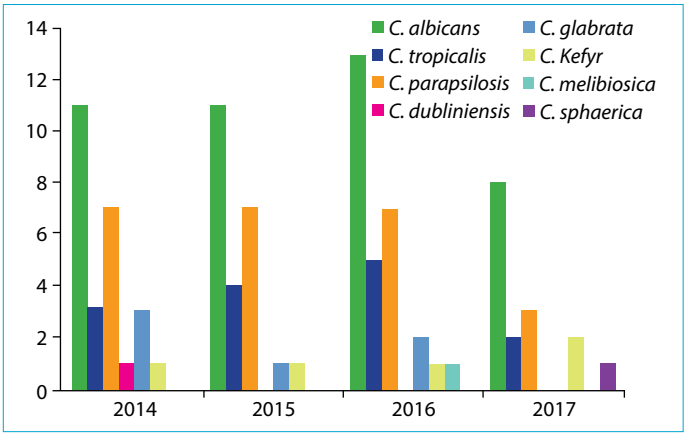

Figure 1. Distribution of *Candida* strains in blood cultures for years.

13 (44.8%); for *C. albicans*, 7 (24.1%); for *C. parapsilosis*, 5 (17.2%); for *C. tropicalis*, 2 (6.8%); for *C. glabrata*, and 1 (3.4%); for *C. kefyr* and *C. melibiosica*, respectively.

Until September of 2017, a total of 16 cases of yeast were detected, 14 in ICU, 2 in other clinics. The number of species distributions: 8 (50%); for *C. albicans*, 3 (%18.7); for *C. parapsilosis*, 2 (%12.5); for *C. kefyr* and *C. tropicalis*, 1 (%6.2); for *C. sphaerica*, respectively.

In addition, in a blood culture from 1 ICU patient, both *C. kefyr* and *C. sphaerica* were isolated at the same time.

When all the years are considered, the species distribution can be as follows; within the four years, it was observed that among the 95 candida strains growing in blood cultures, the most common strains were *C. albicans* 43 (45.2%). In the second place, *C. parapsilosis* (24 (25.2%)) was followed by *C. tropicalis*, *C. glabrata* and *C. kefyr* (14 (14.7%), 6 (6.3%), and 5 (5.2%), respectively).

In addition, there are also strains; *C. dubliniensis*, *C. sphaerica* and *C. melibiosica* (1 (1%)). In a blood culture, *C. kefyr* and *C. sphaerica* were also isolated together (Fig. 1).

Discussion

Thanks to modern technology, the life span of people is prolonged. In contrast, the frequency of interventional procedures, the number of immunosuppressive therapies and the broad spectrum antibiotic use increase. Therefore, there is an increase in the incidence of *Candida species* as an end-effector, infection-affecting duration of hospital stay.[7-9] This increase led *Candida species* to fourth place in nosocomial infections.[3, 4] Although the frequency of non-albicans Candida increases among candidaemia, *C. albicans* is the most common causative factor.[10]

In the study conducted by Horvath et al.,[11] color or colony morphology was observed among the 50 Candida strains isolated from the blood culture using two different

medium (SDA with chromogenic agar). *C. albicans* (n-12), *C. tropicalis* (n-12), *C. glabrata* (n-9) and *C. krusei* (n-5) isolates were the most frequent isolates. There was also no significant difference between the two medium in terms of color and colony morphology. In our study, 5% sheep blood agar and SDA mediums were used. However, no evaluation was made between color and colony morphology between the two media. And *C. albicans* was the most common species with 43 (45.2%).

In the study conducted by Adiloglu et al.,[12] API ID 32 C kit was used. In the definition, *C. albicans* 31 (81.6%) was followed by *C. glabrata*, *C. tropicalis* and *C. parapsilosis* (5 (13.2%), 1 (2.6%) and 1 (2.6%), respectively). Eksi et al.[13] studied 95 Candida strains and found that 70 (73.6%) were *Candida albicans* and 25 (26.3%) were Candida except *Candida albicans*. In the study of Comert et al.,[14] a total of 320 Candida strains isolated from intensive care unit patients and 7% from blood cultures were obtained from different cultures, 65.6% were *C.albicans*, 11.3% were *C. parapsilosis*, 8.8% to *C. glabrata*, and 7.8% to *C. tropicalis*. In the study of Zer et al.,[15] the total distribution of 205 Candida strains isolated from different cultures, 11% blood from patients in intensive care unit, were 56.1% *C.albicans*, 11.2% C.tropicalis, 10.2% C .parapsilosis, 5.8% *C. glabrata*, 4.4% *C. kefyr*, 3.4% *C. lucitaniae*, 2.9% *C. famata*, 2.9% *C.krusei* and 2.9% *C. guilliermondii*. In a multicenter study of Pfaller et al.,[16] 6082 Candida strains affecting bloodstream infections were evaluated, 55.9% of them were *C. albicans*, 16.2% of *C. glabrata*, 13.1% *C. parapsilosis*, 9.6% *C. tropicalis*, 2.5% *C. krusei* and 2.7% other *Candida species*. The study by Motta et al.,[17] examined the distribution of isolated fungi from blood cultures from patients in a Brazilian hospital. According to the results of this study; *C. albicans* was found in the first place with (52.2%), followed by *C. parapsilosis* (22.1%), *C. tropicalis* (14.8%) and *C. glabrata* (6.6%). In the study carried out by Pelit et al.,[18] when the distribution at species level was examined for a total of 121 Candida strains isolated from different cultures, (45 (37%) from blood cultures), *C. albicans* in 60 (49%), *C. tropicalis* in 21 (17.3%), *C. parapsilosis* in 17 (14%), *C. glabrata* in 15 (12%), C. keyfr in 3 (2.5%), *C. krusei* in 2 (1.7%), *C. lusitaniae*, *C. famata* and C. lipolytica in 1 were defined. The results of our study are in accordance with the above studies; *C. albicans* was found in the first place with 45.2% followed by *C. parapsilosis* 25.2% and *C. tropicalis* 14.7%. However, some authors reported that the most common cause of candidiasis is non-albicans Candida, with the results obtained in the study they conducted, unlike our study.

In a study conducted by Dutta et al.,[19] in India, 85 *Candida species* and antifungal susceptibilities were examined retrospectively from clinical samples of patients in the intensive care unit. Sabouraud Dextrose Agar, Cornmeal Agar and Chromogenic agar media were used for culture and morphological examination. In addition, species identification was performed using an automated identification system. According to this, out of 85 Candida isolates, Candida tropicalis (with 38%) was the most common, in all age groups. In a study conducted in Spain, Amphotericin B, fluconazole, itraconazole and flucytosine minimal inhibitory concentrations (MICs) were determined using the Sensititre YeastOne broth microdilution assay for the 53 isolates detected. *C. parapsilosis* was present in 41.5% of cases, followed by *C. albicans* (35.8%), *C. glabrata* (9.4%), *C. krusei* (5.5%), *C. tropicalis* (3.7%) and *C. guilliermondii* (3.7%). None of the isolates presented an amphotericin B MIC>1 micro g/ml. All the *C. krusei* isolates were resistant to fluconazole. Itraconazole resistance and dose-dependent fluconazole susceptibility was found in 80% of *C. glabrata* isolates. Only one *C. parapsilosis* isolate was resistant to flucytosine.[20]

In the study of Aydemir et al.,[21] 50 yeast strains cultured in blood culture were evaluated using conventional and Peptide Nucleic Acid Fluorescent In Situ Hybridization (PNA FISH) methods. As a result of conventional (morphological and biochemical) methods; 38% *C. albicans*, 24% *C. glabrata*, 10% *C. parapsilosis*, 10% *C. kefyr*, 8% *C. krusei*, 4% *C. guilliermondii*, 4% *C. tropicalis* and 2% *C. lusitaniae*. 24 (48%) strains were identified as *C.albicans*/*C. parapsilosis*, 16 (32%) *C. glabrata*/*C. krusei* and 1 (2%) *C. tropicalis* by PNA FISH method. But, *C. tropicalis* strain gave wrong result as *C.albicans*. In a study conducted in South Korea, *C. albicans* was found to be 38%, *C. parapsilosis* 26% and *C. tropicalis* 20%.[22] In the study of Sahiner et al.,[23] the most common factors were *C.parapsilosis* (38.5%), *C. tropicalis* (30.8%) and *C. albicans* (26.9%). In the study of Etiz et al.,[24] *C. parapsilosis* (33.9%), *C.albicans* (27.5%) and *C. tropicalis* (16%) were found to be the leading cause of candidiasis. When we compared our results with other studies, we found that *C. parapsilosis* ratio was higher and *C. albicans* ratio was lower. This has been interpreted as an indication of the increasing importance of non-albicans *Candida species* as a cause of opportunistic infection in our hospital, as it is all over the world. In addition, among our *Candida species* identified in our study, there are rare species such as *C. sphaerica* and C. haemulonii. In our study, in the cases of candidiasis reported from our country, *C. albicans* is in the first rank and *C. parapsilosis* is in the second rank, although different rates are given from various centers.

In the study of Bayram et al.,[6] two *Candida species* (*C. parapsilosis*-*C. albicans*) were observed in one of the cases, at the sama time, and two *Candida species* (*C. glabrata*-*C.parapsilosis* or *C. albicans*- *C. parapsilosis*) were observed in two of the cases, at the different times.

In the study of Etiz et al.,[24] in the 5 case, two types of Candida (*C. famata-C. parapsilosis*, or *C. kefyr-C. lusitaniae*, or *C. albicans-C. parapsilosis*, or *C. glabrata-C. tropicalis*, or *C. albicans-C. glabrata*) were reported to be isolated at the same time.

In various studies conducted in our country and abroad, rates of polyfungal candidiasis have been reported between 2-5%. In polyfungal infections, wide spectrum antibiotic administration is of vital importance when antifungal therapy is given to the patient. Species with polyfungal candidiasis were isolated from patients hospitalized in pediatric intensive care and internal medicine oncology services. [25, 26] Again, in our study, *Candida kefyr-Candida sphaerica* was isolated at the same time and in the same culture.

Conclusion

Candida species are emerging as an important factor in increasing morbidity and mortality especially at the patients' infections in intensive care units. The frequency of occurrence among species does not show a geographical feature. And strains isolated due to their different antifungal resistance profile need to be identified shortly. In addition, the early onset of empirical antifungal therapy makes a significant contribution to the treatment of patients, especially in units that cannot be tested for antifungal susceptibility. For this reason, we believe that hospitals will be highly valued in terms of their own protocols for antifungal use by evaluating yeast species growing in their own units.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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