



This article is cited as: Kaya G., İncirkuş Küçük H., Yılmaz Erbay E., Solmaz ., Oskay M., Han R. (2026). The Impact of the COVID-19 Pandemic on the Epidemiology of Candidemia and the Distribution of Candida Species, Mantar Dergisi, 17(2) 99-107.

Geliş(Received) :18.03.2026

Kabul(Accepted) :07.05.2026

Research Article

Doi: 10.30708/mantar.1912728

The Impact of the COVID-19 Pandemic on the Epidemiology of Candidemia and the Distribution of *Candida* Species

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Abstract: Candidemia is a critical bloodstream infection with high mortality rates, particularly in intensive care units. Several studies have reported an increase in the incidence of candidemia in intensive care units (ICUs) and changes in distribution of causative *Candida* species during the COVID-19 pandemic. This retrospective study aims to evaluate changes in the distribution of *Candida* species isolated from blood cultures from ICUs in the Medical Microbiology Laboratory of Yalova Training and Research Hospital in the periods before (2016–2019) and after (2020–2024) the COVID-19 pandemic. Blood cultures were incubated using the Render BC128 and DL-Bt 112 automated blood culture systems; species identification was performed using the VITEK® automated identification system in both periods. Analyses revealed a statistically significant increase in the isolation rate of *Candida albicans* in post-pandemic period (from 65.2% to 84.0%; $p=0.033$) and a significant decrease in isolation rate of *Candida parapsilosis* (from 15.2% to 2.0%; $p=0.019$). No significant differences were observed in other *Candida* species. Data indicate that COVID-19 pandemic has led to a significant change in species distribution of candidemia agents. In particular, increase in isolation frequency of *C. albicans* and the significant decrease in *C. parapsilosis* point to the need to review clinical management approaches and empirical antifungal treatment strategies. It is thought that changes in infection control practices and differentiations in patient profiles and intensive care dynamics during pandemic may have influenced this distribution. Our findings once again emphasize importance of regular surveillance, rapid species-level diagnostic methods, and antifungal susceptibility monitoring in clinical practice for candidemia.

Keywords: COVID-19, Candidemia, *Candida* species, Epidemiology, Intensive care unit



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COVID-19 Pandemisinin Kandidemi Epidemiyolojisi ve *Candida* Tür Dağılımına Etkisi

Öz: Kandidemi, özellikle yoğun bakım ünitelerinde yüksek mortalite oranlarıyla seyreden kritik bir kan dolaşımı enfeksiyonudur. COVID-19 pandemisi sürecinde, yoğun bakım ünitelerinde (YBÜ) kandidemi insidansının arttığı ve etken *Candida* türlerinin dağılımında değişikliklerin yaşandığı çeşitli çalışmalarda bildirilmiştir. Bu retrospektif çalışmada, COVID-19 pandemisi öncesi (2016–2019) ve sonrası (2020–2024) dönemlerde, Yalova Eğitim ve Araştırma Hastanesi Tıbbi Mikrobiyoloji Laboratuvarı'nda YBÜ'den gelen kan kültürlerinden izole edilen *Candida* türlerinin dağılımındaki değişimlerin değerlendirilmesi amaçlanmıştır. Kan kültürleri Render BC128 ve DL-Bt 112 otomatik kan kültürü sistemleri ile inkübe edilmiş; tür identifikasyonu her iki dönemde de VITEK® otomatik identifikasyon sistemi ile gerçekleştirilmiştir. Analizler sonucunda, pandemi sonrası dönemde *Candida albicans* izolasyon oranında istatistiksel olarak anlamlı bir artış (%65.2'den %84.0'e; $p=0.033$) ve *Candida parapsilosis* oranında ise anlamlı bir azalma (%15.2'den %2.0'ye; $p=0.019$) saptanmıştır. Diğer *Candida* türlerinde anlamlı bir farklılık izlenmemiştir. Elde edilen veriler, COVID-19 pandemisinin kandidemi etkenlerinin tür dağılımı üzerinde dikkate değer bir değişime yol açtığını göstermektedir. Özellikle *C. albicans*'ın izolasyon sıklığındaki artış ve *C. parapsilosis*'in belirgin azalışı, klinik yönetim yaklaşımlarının ve empirik antifungal tedavi stratejilerinin gözden geçirilmesi gerekliliğine işaret etmektedir. Pandemi sürecinde enfeksiyon kontrol uygulamalarındaki değişiklikler ve hasta profili ve yoğun bakım dinamiklerindeki farklılaşmaların bu dağılım üzerinde etkili olabileceği düşünülmektedir. Bulgularımız, kandidemiye yönelik düzenli surveyans, tür düzeyinde hızlı tanı yöntemleri ve antifungal duyarlılık izleminin klinik pratikteki önemini bir kez daha vurgulamaktadır.

Anahtar kelimeler: COVID-19, Kandidemi, *Candida* türleri, Epidemiyoloji, Yoğun bakım ünitesi

Introduction

The COVID-19 pandemic has placed a significant burden on healthcare systems, particularly increasing the risk of secondary infections in patients monitored in intensive care units (ICUs). During this period, an increase in cases of candidemia, a significant invasive fungal infection, has been reported. Candidemia is considered a major clinical problem among healthcare-associated infections due to its high mortality rate, difficulties in diagnosis and treatment, and increasing antifungal resistance (Arendrup, 2017; Pappas et al., 2018). The distribution of *Candida* species is influenced by several factors, including the hospital environment, the use of broad-spectrum antibiotics, invasive procedures, and immunosuppressive therapies (Lamoth & Kontoyannis, 2018; Guinea, 2014). During the pandemic, longer hospital stays, increased ICU requirements, and more frequent use of immunosuppressive therapies created conditions that could lead to changes in the epidemiology of *Candida* infections (Song et al., 2020).

Recent studies indicate that the COVID-19 pandemic may have caused specific changes in the distribution of *Candida* species, which are causative agents of candidemia (El Zakhem et al., 2023; Şevfik et al., 2025). While *Candida albicans* (*C. albicans*) (C.P. Robin) Berkhout (pamukçuk) (Sesli ve ark., 2020) was reported as the most frequently isolated species before the pandemic, non-albicans *Candida* species have also

been shown to have a significant share (Chowdhary et al., 2017). In contrast, some studies after the pandemic have observed an increase in *C. albicans* isolation rates, while a decrease in the frequency of some non-albicans *Candida* species, especially *Candida parapsilosis* (*C. parapsilosis*) (Ashford) Langeron & Talice (kan mayası) (Sesli ve ark., 2020), has been reported (El Zakhem et al., 2023). This change is thought to be related to infection control strategies implemented during the pandemic, differences in patient profiles, and changes in treatment approaches. This study aims to compare the distribution of *Candida* species isolated from blood cultures before and after the pandemic and to evaluate epidemiological changes.

Material and Method

In this retrospective and descriptive study, fungal agents isolated from blood cultures from the ICU at the Medical Microbiology Laboratory of Yalova Training and Research Hospital between 2016 and 2024 were evaluated. Ethical approval for the study was obtained from the Non-Interventional Clinical Research Ethics Committee of Health Sciences, Yalova University Ethics Committees Coordination Office (30.10.2025; Protocol No: 2025/410), and the research process was conducted in accordance with the principles of the Helsinki Declaration.

The study was divided into two periods: the pre-COVID-19 pandemic period (Pre-P) (January 2016 – December 2019) and the post-pandemic period (Post-P) (January 2020 – December 2024). Data on fungal growth detected in blood cultures were obtained retrospectively from the hospital information management system, and the findings were analyzed in terms of pre- and post-COVID-19 pandemic periods.

Blood culture samples were incubated in automated blood culture systems in both periods. Blood culture samples were analyzed using the Render BC128 System (Render Biotech Co. Ltd., Shenzhen, China) and the DL-Bt 112 (Zhuhai DL Biotech Co., Ltd., China) automated blood culture detection system. Gram staining was performed on blood culture bottles giving a positive signal, and samples were plated onto appropriate solid media. The plated cultures were incubated at 35–37 °C for 24–48 hours. Species-level identification of isolated yeast colonies was performed in both periods using the VITEK® (bioMérieux, Marcy-l'Étoile, France) automated identification system. Colony morphology and microscopic examination results were also evaluated during the identification process.

In this study, recurrent fungal growths isolated from the same patient during the same infection episode were excluded from evaluation, and only the initial isolate for each patient was included in the analyses. However, isolates detected at different times in the same patient and considered as a new infection episode clinically and microbiologically were included in the study. A new episode was defined according to the following criteria: at least 14 days had passed since the previous infection, despite antifungal treatment; the patient presented with new clinical findings; and the isolated fungal species or antifungal susceptibility profile differed from the previous episode (e.g., species change or a significant minimal increase in inhibitory concentration).

Isolated fungal species and patient data were analyzed using the SPSS 22.0 statistical package program. Study data were presented as numbers and percentages for categorical variables, and the relationships between categorical variables were evaluated using the Chi-square test. The statistical significance level was accepted as $p < 0.05$.

Results

When the age distribution of the patients included in the study was examined, it was determined that the median age of patients in Pre-P was 75.5 years and in Post-P was 79.0 years, and no statistically significant difference was found in age distribution between the two periods ($p=0.493$). When patients were evaluated according to gender, it was determined that 50.0% of the

patients in Pre-P were male and this rate was 52.0% in Post-P, and no statistically significant difference was found in gender distribution between the groups ($p=0.845$). When clinical outcomes were examined, the mortality rate was found to be 34.7% ($n=16$) in Pre-P, while this rate increased to 80.0% ($n=40$) in Post-P, and a statistically significant difference was found in mortality rates between the periods ($p<0.001$) (Table 1). Among patients with candidemia who were COVID-19 positive (18.0%, $n=9$), 8 (88.9%) died, while 1 (11.1%) was discharged ($p = 0.044$). The comorbid characteristics, invasive procedures, and clinical outcomes of patients with candidemia according to the study periods are presented in Table 1.

When blood culture data were evaluated according to study periods; a total of 966 blood cultures were requested in Pre-P, and growth was detected in 171 (17.7%) of them. In this period, fungal growth was determined in 46 (26.9%) of the positive cultures. In Post-P, 1583 blood cultures were evaluated, 238 (15.0%) of which were found to be positive, and fungal growth was detected in 50 (21.0%). When the two periods were compared, no statistically significant difference was found in terms of growth rates and fungal isolation rates in blood cultures ($p=0.075$; $p=0.165$, respectively).

When the distribution of *Candida* species according to periods was examined, *C. albicans* was detected in 65.2% and non-*albicans Candida* species in 34.8% in Pre-P. In Post-P, it was determined that the proportion of *C. albicans* increased to 84%, while the proportion of non-*albicans Candida* species decreased to 16%. These proportions were found to be statistically significant between periods ($p=0.034$) (Figure 1).

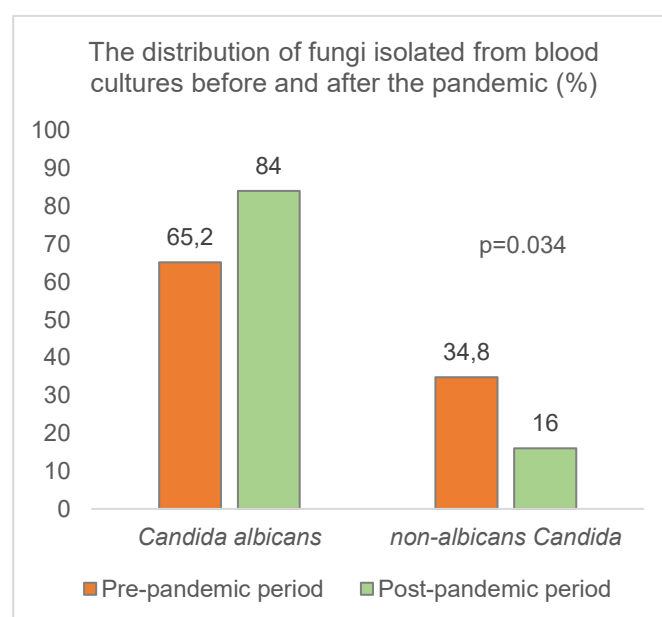


Figure 1. Distribution of fungi isolated from blood cultures before and after the pandemic.

In the species-based evaluation, differences were observed in the frequency of some *Candida* species between Pre-P and Post-P. *C. albicans* was detected in 65.2% (n=30) of Pre-P, while this rate increased to 84.0% (n=42) in Post-P, and this increase was found to be statistically significant (p=0.033). *C. parapsilosis* was isolated in 15.2% (n=7) of Pre-P, while it decreased to 2.0% (n=1) in Post-P, and this decrease was also found to be statistically significant (p=0.019). However, no statistically significant difference was found between Pre-P and Post-P in terms of the frequency of *Candida famata* (F.C. Harrison) E.K. Novák & Zsolt, *Candida glabrata* (H.W. Anderson) S.A. Mey. & Yarrow (düzmayı) (Sesli ve ark., 2020), *Candida lusitanae* Uden & Carmo Souza,

and *Candida tropicalis* (Castell.) Berkhout species (yuvarlakmaya) (Sesli ve ark., 2020) (p = 0.136; p = 0.578; p = 0.294; p = 0.091, respectively) (Table 2).

Antifungal susceptibility testing of *Candida* isolates demonstrated high overall susceptibility rates to the tested agents, including azoles, echinocandins, and amphotericin B, in both pre- and post-pandemic periods (Table 3).

The results of the univariate and multivariate logistic regression analyses for predictors of in-hospital mortality in patients with candidemia are presented in Table 4.

Table 1. Demographic characteristics and clinical outcomes of patients diagnosed with candidemia before and after the pandemic.

Patient characteristics	Pre-pandemic period n (%) / Median [IQR]	Post-pandemic period n (%) / Median [IQR]	P value*
Age	75.5 [59.7-84.2]	79.0 [65.5-83.5]	0.493
Gender			
Male	23 (50.0)	26 (52.0)	0.845
Female	23 (50.0)	24 (48.0)	
Presence of comorbidity	41 (89.1)	37 (74.0)	0.058
Distribution of comorbidities			
Chronic kidney disease	9 (19.6)	13 (26.0)	0.454
Coronary artery disease	4 (8.7)	5 (10.0)	0.827
Hypertension	7 (15.2)	9 (18.0)	0.715
COPD	7 (15.2)	4 (8.0)	0.267
Diabetes mellitus	5 (10.9)	11 (22.0)	0.144
Cerebrovascular disease	5 (10.9)	5 (10.0)	0.889
Malignancy	2 (4.3)	2 (4.0)	0.932
Alzheimer's disease	9 (19.6)	8 (16.0)	0.648
Heart failure	6 (13.0)	1 (2.0)	0.038
Neurological disease	6 (13.0)	3 (6.0)	0.237
Invasive devices, procedures, and other factors			
History of surgery	4 (8.7)	3 (6.0)	0.612
Trauma	2 (4.3)	3 (6.0)	0.716
Cardiopulmonary resuscitation	21 (45.7)	5 (70.0)	0.016
Central venous catheter	36 (78.3)	35 (70.0)	0.357
Mechanical ventilation	35 (76.1)	25 (50.0)	0.008
Urinary catheter	46 (100.0)	50 (100.0)	1.000
Nasogastric tube	33 (71.7)	38 (76.0)	0.635
Tracheostomy	6 (13.0)	2 (4.0)	0.109
PEG tube	8 (17.4)	6 (12.0)	0.455
Corticosteroid use	28 (60.9)	29 (58.0)	0.775
Pre-culture antibiotic use	42 (91.3)	49 (98.0)	0.140
Pre-culture antifungal use	16 (34.8)	20 (40.0)	0.598
COVID-19 positivity	0	9 (18.0)	0.003
Outcome			
Discharge	31 (67.3)	10 (20.0)	0.001
Death	16 (34.7)	40 (80.0)	

IQR, interquartile range; COPD, chronic obstructive pulmonary disease; PEG, percutaneous endoscopic gastrostomy; COVID-19, Coronavirus Disease 2019, Data are presented as number (percentage) or median [interquartile range], as appropriate. P values were calculated using appropriate statistical tests (Chi-square or Fisher's exact test for categorical variables and Mann-Whitney U test for continuous variables). A P value < 0.05 was considered statistically significant.

Table 2. Comparison of the distribution of *Candida* species isolated from blood cultures by period.

Type of microorganism	Pre-pandemic period n (%)	Post-pandemic period n (%)	p value*
Total number of blood cultures	966	1583	
Number of blood cultures showing growth	171 (17.7)	238 (15.0)	0.075
Number of blood cultures showing fungal growth	46 (26.9)	50 (21.0)	0.165
Fungi isolated from blood cultures			
<i>Candida albicans</i>	30 (65.2)	42 (84.0)	0.033
<i>Candida famata</i>	2 (4.3)	0	0.136
<i>Candida glabrata</i>	3 (6.5)	2 (4.0)	0.578
<i>Candida lusitanae</i>	1 (2.2)	0	0.294
<i>Candida parapsilosis</i>	7 (15.2)	1 (2.0)	0.019
<i>Candida tropicalis</i>	0	3 (6.0)	0.091
<i>Candida</i> spp.	3 (6.5)	2 (4.0)	0.548

* Chi-square test, p<0.05

Table 3. Antifungal Susceptibility Rates of *Candida* Isolates (%)

Antifungal agent	Total		Pre-pandemic period		Post-pandemic period	
	Susceptible n (%)	Resistant n (%)	Susceptible n (%)	Resistant n (%)	Susceptible n (%)	Resistant n (%)
Flucytosine	17 (100)	0	14 (100)	0	3 (100)	0
Voriconazole	13 (100)	0	10 (100)	0	3 (100)	0
Micafungin	18 (90.0)	2 (10.0)	11 (84.6)	2 (15.4)	7 (100)	0
Caspofungin	17 (80.9)	4 (19.1)	8 (66.7)	4 (33.3)	9 (100)	0
Amphotericin B	20 (100)	0	14 (100)	0	6 (100)	0
Fluconazole	17 (89.5)	2 (10.5)	9 (81.8)	2 (18.2)	8 (100)	0

Table 4. Univariate and multivariate logistic regression analyses of predictors of in-hospital mortality in patients with candidemia

Variables	Univariate OR (95% CI)	P value	Multivariate OR (95% CI)	P value
Hypertension	0.12 (0.03–0.47)	0.002	0.06 (0.009–0.441)	0.005
History of surgery	0.10 (0.01–0.93)	0.043	0.60 (0.05–7.16)	0.693
Cardiopulmonary resuscitation	9.66 (3.76–24.81)	<0.001	6.99 (2.18–22.33)	0.001
COVID-19 positivity	6.80 (0.81–56.79)	0.076	3.02 (0.13–67.50)	0.484
Post-pandemic period	8.26 (3.27–20.89)	<0.001	12.62 (3.38–47.06)	<0.001

OR, odds ratio; CI, confidence interval; COVID-19, Coronavirus Disease 2019. Univariate and multivariate logistic regression analyses were performed to identify predictors of in-hospital mortality. Variables with $P < 0.05$ in univariate analysis were included in the multivariate model. A P value < 0.05 was considered statistically significant.

Discussions

This study investigated changes in the distribution of *Candida* species isolated from blood cultures in Pre-P and Post-P. Our findings revealed a significant increase in the prevalence of *C. albicans* in Post-P (from 65.2% to 84.0%; $p=0.033$), while the overall prevalence of non-*albicans* *Candida* species decreased. Specifically, a significant decrease in the isolation rate of *C. parapsilosis* was observed in Post-P compared to Pre-P (from 15.2% to 2.0%; $p=0.019$). On the other hand, no statistically significant changes were observed in the frequency of *C.*

famata, *C. glabrata*, *C. lusitanae*, and *C. tropicalis* between the periods. These findings suggest that the COVID-19 pandemic may have led to significant epidemiological changes in the species distribution of candidemia agents.

Candidemia is gaining importance as a nosocomial and invasive infection, particularly in ICUs, leading to significant mortality (Pappas et al., 2018). Multicenter studies conducted in Türkiye have revealed that *Candida* species are the most frequently isolated fungal pathogens in bloodstream infections (Eren et al., 2020; Şanlı et al.,

2021). However, current literature reports an increasing isolation of non-albicans *Candida* species, a trend that points to new clinical challenges in the diagnosis, treatment, and management of hospital-acquired fungal infections (Guinea, 2014; Lamoth & Kontoyiannis, 2018).

Many studies have reported a significant increase in mortality rates due to candidemia during the COVID-19 period (Aydın et al., 2024; Bauer et al., 2023; Kazancıoğlu et al., 2024). In our study, the mortality rate was 34.7% in the post-COVID period, while it increased to 80.0% in the post-COVID period, and the difference between the periods was found to be statistically significant ($p < 0.001$). Similarly, high mortality rates have been reported in COVID-19-related candidemia cases in the literature (Srisurapanont et al., 2024; Yılmaz Karadağ et al., 2025). In systematic review and meta-analysis studies, the mortality rate in COVID-19-related candidemia cases in the ICU was determined as 68.4% (95% CI: 61.86–74.28); A US-based study found that hospital mortality was significantly higher in COVID-19-related candidemia patients compared to the control group (68% vs. 40%; $p < 0.01$) (Srisurapanont et al., 2024; Dixit et al., 2022). In a study conducted in our country, the mortality rate due to candidemia in COVID-19 patients in the ICU of a tertiary teaching hospital was reported as 80.2% (Yılmaz Karadağ et al., 2025). Our study results are consistent with the literature, and these findings suggest that the risk of mortality is significantly increased in COVID-19-related candidemia cases and that clinical prognosis is negatively affected during the pandemic period.

The pandemic has significantly altered patient profiles, treatment protocols, and infection control measures in hospitals. Factors such as increased ICU admissions, broad-spectrum antibiotic use, immunomodulatory therapies, and the proliferation of invasive procedures have been reported to influence the epidemiology of candidemia during the COVID-19 period (Song et al., 2020; Rawson et al., 2020; Lansbury et al., 2020). Recent multicenter studies have also shown that these changes directly affect the distribution of *Candida* species; in particular, the increase in ICU admissions due to COVID-19, long-term antibiotic and corticosteroid use, immunosuppression, and the frequency of invasive procedures affect the incidence and species distribution of candidemia (Machado et al., 2022; Machado et al., 2022; Brandt et al., 2024).

Routsis et al. observed an increase in the rate of *C. albicans* before the COVID-19 pandemic and an increase in the rate of non-albicans *Candida* species during the pandemic, but this change was not statistically significant ($p = 0.069$) (Routsis et al., 2022). In the study by Ramos-Martínez et al., a significant increase in bloodstream infections caused by *C. parapsilosis* was detected in the

post-pandemic period ($p = 0.024$), while no significant change was reported in the rates of *C. albicans* and *C. glabrata* ($p > 0.05$) (Ramos-Martínez et al., 2022). In a study conducted in our country, a significant increase in the isolation rate of *C. parapsilosis* in Post-P was detected (from 14% to 23%; $p = 0.001$), while a significant decrease was found in other *Candida* species (from 9% to 2%; $p < 0.001$); No significant change was observed in the rates of *C. albicans* and *C. glabrata* ($p > 0.05$) (Şevik et al., 2025). However, Aydoğan et al. evaluated 84 *Candida* strains isolated from blood cultures during the pandemic and reported that the main causative agents were *C. albicans* (42.8%) and *C. parapsilosis* (28.6%), while *C. glabrata*, *C. tropicalis*, *C. krusei*, *C. guilliermondii*, and *C. sphaerica* were detected at lower rates (Aydoğan et al., 2022). In our study, the rate of *C. albicans* was 65.2% in Pre-P, while this rate increased to 84.0% in Post-P, and the increase was found to be statistically significant ($p = 0.033$). The total rate of non-albicans *Candida* species decreased from 34.8% before the pandemic to 16% after the pandemic. Our findings, along with variability reported in the literature, indicate that the COVID-19 pandemic may create regional and inter-institutional differences in the distribution of *Candida* species causing candidemia. In this context, monitoring changes in species distribution, strengthening epidemiological surveillance, and maintaining infection control measures are critically important in candidemia management.

C. parapsilosis is known to be a significant causative agent, particularly in infections associated with intravascular catheters and nosocomial candidemia related to the hand flora of healthcare workers (Trofa et al., 2008; Tóth et al., 2019). Due to its common occurrence in healthcare-associated infections, it is reported to be closely related to the effectiveness of infection control practices (Nucci et al., 2013). In our study, a statistically significant decrease in the isolation rate of *C. parapsilosis* was detected in Post-P ($p = 0.019$). It is thought that factors such as strengthening infection control measures in healthcare facilities, tightening hand hygiene practices, increased use of personal protective equipment, and increased awareness during the COVID-19 pandemic may have contributed to the decrease in the rate of *C. parapsilosis*.

This study has several limitations. Firstly, its single-center, retrospective design restricts the generalizability of the findings; the distribution of *Candida* species and mortality rates may differ in different geographic regions or healthcare institutions. Secondly, differences in the methods used for species identification before and after the pandemic may limit the detection of rare *Candida* species in particular. Furthermore, the lack of access to antifungal susceptibility data and detailed clinical

information on patients (e.g., comorbidities, treatment protocols, invasive procedures, and length of stay) makes it difficult to comprehensively analyze the causes of changes in mortality and pathogen distribution. Finally, it should be considered that external factors such as hospital workload, patient profile, and differences in infection control practices during the pandemic may also affect the results of the study. Therefore, further multi-center, prospective research encompassing larger patient populations is needed to validate the findings and increase their generalizability.

The COVID-19 pandemic led to notable changes in the distribution of *Candida* species causing candidemia as well as in associated mortality. In the post-pandemic period, a significant increase in the proportion of *C. albicans* was observed, whereas non-albicans *Candida* species, particularly *C. parapsilosis*, showed a marked decrease. These shifts may be related to increased ICU admission rates, a higher frequency of invasive procedures, extensive use of broad-spectrum antibiotics and immunomodulatory agents, and changes in infection control practices during the pandemic period. In addition, candidemia-associated mortality increased dramatically during the pandemic period in our study. Overall, our findings suggest that the COVID-19 pandemic not only influenced the incidence and species distribution of candidemia but also adversely affected its clinical course and prognosis. Therefore, continuous monitoring of species distribution, maintenance of strict infection control measures, and early diagnosis with prompt initiation of appropriate antifungal therapy in high-risk patients are of critical importance. In the post-pandemic period,

multidisciplinary approaches and ongoing epidemiological surveillance remain essential to reduce candidemia-related mortality in intensive care units and to control its incidence.

Author contributions

Gülsüm Kaya, Hülya İncirkuş Küçük, Ece Yılmaz Erbay, Sinem Solmaz, Mehtap Oskay and Ramazan Han contributed to the concept and design of the study. Gülsüm Kaya, Hülya İncirkuş Küçük and Ece Yılmaz contributed to the data collection process. Gülsüm Kaya performed the statistical analysis. Gülsüm Kaya, Hülya İncirkuş Küçük, Ece Yılmaz Erbay, Sinem Solmaz, Mehtap Oskay and Ramazan Han drafted the article. All authors contributed to the analysis and interpretation of the data and critically reviewed the article. All authors approved the final version of the article.

Conflicts of interest

The authors declare no competing interests.

Ethical Statement:

Ethical approval for the study was obtained from the Yalova University Ethics Committee Coordination Office, Non-Interventional Clinical Research Ethics Committee for Health Sciences (30.10.2025; Protocol No: 2025/410), and the research process was conducted in accordance with the principles of the Helsinki Declaration (Gülsüm KAYA, Hülya İNCİRKUŞ KÜÇÜK, Ece YILMAZ ERBAY, Sinem SOLMAZ, Mehtap OSKAY, Ramazan HAN).

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