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Evaluation of candidemia cases in the intensive care unit of a tertiary training hospital during the period of COVID-19 pandemic

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Abstract

Background Many risk factors, including COVID-19 infection, lead to the development of invasive *Candida* infection in intensive care unit patients. The aim of this study was to evaluate the risk factors affecting mortality along with the clinical characteristics of candidemia patients.

Methods This retrospective study was conducted among patients hospitalized at the Anesthesiology and Reanimation Clinic between June 2020 and December 2021. The clinical and laboratory characteristics of 165 patients with candidemia were recorded. The difference between patients with and without COVID-19 infection was evaluated statistically. Multivariate analysis was performed to determine factors affecting mortality.

Results A total of 165 patients were included in the study, 52.1% of whom were male. The mean age of the patients was 66.5 (median 18–97) years. The percentage of patients with COVID-19 infection was 70.9%. The mean leukocyte count and aspartate transaminase, alanine transaminase, C-reactive protein, lactate dehydrogenase, ferritin, and D-dimer levels were significantly greater in COVID-19 patients than non COVID-19 patients ($p < 0.05$). The mortality rate in patients with candidemia was 80.2%. The presence of comorbidities, corticosteroid use, advanced age, and high ferritin and D-dimer levels negatively affected mortality, according to the multivariate analysis results. *C. albicans* was the most frequently isolated *Candida* species.

Conclusions We detected higher mortality rates in patients with candidemia who were elderly, had comorbidities, received corticosteroid treatment and had elevated ferritin and D-dimer levels. When steroids are used, it is necessary to remember that this drug is a double-edged sword and to be careful of fungal infections.

Keywords Candida, Candidemia, COVID-19, Intensive care unit, Mortality

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Background

Candidemia is one of the most common nosocomial bloodstream infections leading to increased morbidity and mortality in critically ill patients [1]. The use of broad-spectrum antibiotics, multiple invasive procedures, total parenteral nutrition (TPN) and prolonged intensive care unit (ICU) stay are among the risk factors for the development of candidemia [2].

The COVID-19 pandemic has led to an increased demand for intensive care for patients with severe disease, resulting in a greater burden on intensive care units [1]. Acute respiratory distress syndrome (ARDS) and immune dysregulation caused by the COVID-19 virus, immunosuppressive drugs used for treatment, deficiencies in ICU infection control measures, excessive use of antibiotics, and increased *Candida* translocation with disruption of the gastrointestinal mucosal barrier may increase the risk of *Candida* infection in COVID-19 patients [3, 4].

The mortality rate for candidemia patients without COVID-19 infection is typically between 10% and 40%. However, it has been reported that this rate increases to an average of 40–70% in cases of candidemia accompanying COVID-19 infection [4, 5]. This study aimed to identify the factors that contribute to mortality in *Candida* infection patients and to compare candidemia infections in patients with and without COVID-19 infection.

Methods

Study design

This retrospective study was conducted between June 2020 and December 2021 with 165 patients hospitalized at the Anesthesiology and Reanimation Clinic of Sancaktepe Şehit Prof. Dr. İlhan Varan Training and Research Hospital, which has a total bed capacity of 1600 beds. The study was approved by the Sancaktepe Şehit Prof. Dr. İlhan Varan Training and Research Hospital ethics committee (2021/254).

Patient selection and data collection

The clinical, microbiological, and demographic characteristics of patients aged 18 years and older with nosocomial candidemia were obtained from medical records. The standard forms included demographic information (age and sex) as well as underlying diseases, such as diabetes mellitus, hypertension, chronic renal failure, chronic lung disease, neurological disease, hematological malignancy, and solid organ tumors, as well as immunosuppressive drug use. This study collected information on the use of invasive medical devices, including mechanical ventilation, central venous catheters (CVCs) and urinary catheters, as well as surgical operations, transplantation history, neutropenia, broad-spectrum antibiotics, corticosteroids, and TPN.

This research examined the differences between patients diagnosed with COVID-19 and those who were not. In addition, a statistical analysis was performed to evaluate the factors affecting mortality in patients with candidemia.

Definition

Candidemia is defined as the growth of *Candida* species in at least one blood culture that develops 48 h after hospitalization in patients with findings compatible with infection [1]. In patients with recurrent *Candida* growth, the first growth reported in the patient is evaluated. The incidence of candidemia was calculated as the number of episodes per 1000 ICU days. Patients who tested positive for COVID-19 based on PCR or had findings typical of COVID-19 on thorax tomography were diagnosed with COVID-19 disease.

Microbiology

Blood samples from patients were inoculated into BacT/Alert automated blood culture bottles (bioMérieux, France). Positive signals from the bottles were used to passage the samples onto 5% sheep blood agar, Eosin-methylene blue (EMB) agar, and chocolate agar (bioMérieux, France). The samples were then incubated at 37 °C for 24–48 h. Gram staining was performed on the growth medium, and colonies found to be yeast were passaged on Sabouraud dextrose (SDA) agar (bioMérieux, France) and chromogenic agar (bioMérieux, France) and incubated at 37 °C for 24–48 h. Colonies confirmed to be pure on SDA were processed for identification and examined according to the VITEK® MS (bioMérieux, France) device procedure which uses MALDI-TOF MS method. Identification was concluded by comparing the colonies on the chromogenic media.

Antifungal susceptibility testing was performed in accordance with the Clinical and Laboratory Standards Institute guidelines (CLSI) [6]. Minimal inhibitory concentration (MIC) and antifungal susceptibility results were determined using the Sensititre YeastOne Microdilution method (Thermo Scientific, USA). The Sensititre YeastOne is a colorimetric test. After a 24-hour incubation at 37 °C, MICs of antifungal drugs (amphotericin B, fluconazole, caspofungin, anidulafungin and micafungin) were recorded as per the manufacturer's protocol. A total of 162 *Candida* strains were tested. *Candida krusei* ATCC 6258 and *Candida parapsilosis* ATCC 22,019 were employed as quality control strains to ensure test accuracy.

Statistical analysis

The means, standard deviations (SDs), numbers and percentages (%) of the measured patient characteristics and descriptive statistics are presented in the tables. The relationships between COVID-19 positivity and mortality status and categorical characteristics were evaluated using the Pearson Chi-square test or Fisher-Freeman-Halton exact test. The Mann–Whitney U test was used to compare patients who died with those who survived and compare COVID-19-positive patients with COVID-19-negative patients.

Multiple binary logistic regression analysis was used to establish the multivariate model, and the stepwise variable selection method was used to select the variables. A statistical significance level of $P < 0.05$ was accepted. Calculations were performed using the SPSS (ver. 23) program.

Results

A total of 4507 patients were followed up between June 2020 and December 2021 in the Anaesthesiology and Reanimation Unit. A total of 165 patients who developed candidemia were included in the study, 86 (52.1%) of whom were male. The mean age of the patients was 66.5 (median 18–97) years.

The mean length of stay in the intensive care unit of the patients included in the study was 37.0 days. The incidence rate of candidemia was 3.6% during this period. The mean duration of antifungal treatment was 34.5 days.

Among patients diagnosed with COVID-19, 79.5% (93/117) had both PCR positivity and thoracic CT findings. The rate of patients diagnosed with COVID-19 disease exclusively based on thoracic CT findings was 17.9% (21/117), whereas 2.6% (3/117) had a positive PCR test without thoracic CT involvement.

The rate of COVID-19 positivity was significantly higher in patients admitted to the ICU from internal medicine clinics or after emergency admission than in those admitted from surgical clinics. COVID-19 patients had a significantly greater presence of comorbidities, sepsis, and ARDS. Additionally, the rate of corticosteroid use was significantly greater in COVID-19 patients. On the other hand, COVID-19 patients had a significantly lower history of surgical operation (Table 1).

In COVID-19 patients, the duration of central venous catheter use, duration of hospitalization and ICU stay, and total number of antibiotic days were found to be significantly lower, and the duration of corticosteroid use was found to be longer (Table 2).

The mean leukocyte count and aspartate transaminase (AST), alanine transaminase (ALT), C-reactive protein (CRP), lactate dehydrogenase (LDH), ferritin and D-dimer levels were significantly greater in COVID-19 patients (Table 3).

Among COVID-19 patients, mortality was significantly greater in those with comorbidities and a history of chronic renal failure. Mortality was also increased in patients with ARDS or sepsis, those requiring mechanical ventilation, and those receiving corticosteroid treatment. Our study revealed a mortality rate of 80.2%. Table 4 shows the factors that affect mortality.

The results of the multivariate analysis indicate that the presence of comorbidities, corticosteroid use, advanced age, and elevated ferritin and D-dimer levels are significant factors (Table 5).

The most commonly isolated *Candida* species were *C. albicans* (49.1%), *C. parapisilosis* (29.8%), and *C. tropicalis* (12.1%). One isolate each of *C. auris*, *C. lusitaniae*, *C. dubliniensis*, and *C. inconspicua* was detected. The antifungal susceptibilities of the isolated *Candida* species are shown in Table 6. However, no antifungal susceptibility testing was performed for *C. auris*, *C. lusitaniae* or *C. dubliniensis*.

Candida was detected in urine samples from 35.2% of the patients (58/165). A total of 64 isolates, including two different *Candida* species, were obtained from the urine samples of six patients. The isolates were identified as follows: 56.3% as *C. albicans*, 18.7% as *C. glabrata*, 12.5% as *C. tropicalis*, 7.8% as *C. kefyr* and 4.7% as *C. parapsilosis*. The analysis revealed that the presence of candidiuria had no effect on mortality ($p = 0.124$).

Discussion

Candida spp is a significant cause of bloodstream infections in the ICU and poses a threat to the lives of ICU patients, particularly those with COVID-19 [7, 8]. Candidemia has a high mortality rate in COVID-19 patients, with reports indicating that it can reach 83% [8, 9]. In our study, the mortality rate was 82%, which was high. This may be related to the fact that our hospital serves as a center to which critically ill patients from surrounding hospitals are referred. The additional 1000-bed building of our hospital was built to serve COVID-19 patients as a pandemic hospital. Patients in our study were already critically ill, with 70% also having COVID-19, both of which had a negative impact on mortality outcomes.

In our study, the presence of comorbidities, corticosteroid use and advanced age were found to affect mortality in patients with candidemia. Other studies have reported that advanced age is a risk factor for mortality [1, 10]. The IDSA guidelines recommend steroid use in patients with severe COVID-19, and many patients have shown clinical improvement with this

Table 1 The effect of COVID-19 disease on categorical variables in patients with candidemia

		Non-COVID-19 patients (*n*:48)		COVID-19 patients (*n*:117)		*P*
		n	%	*n*	%	
Gender	Female	22	27.8	57	72.2	0.736
	Male	26	30.2	60	69.8	
Clinical follow-up before intensive care unit	Emergency unit	25	33.3	50	66.7	**< 0.001**
	Surgery clinic	11	91.7	1	8.3	
	Internal medicine clinic	12	15.4	66	84.6	
Presence of comorbidity	No	7	14.3	42	85.7	**0.007**
	Yes	41	35.3	75	64.7	
Diabetes mellitus	No	37	28.0	95	72.0	0.549
	Yes	11	33.3	22	66.7	
Chronic renal failure	No	41	29.1	100	70.9	0.993
	Yes	7	29.2	17	70.8	
Hemodialysis	No	44	29.5	105	70.5	0.705
	Yes	4	25.0	12	75.0	
Chronic lung Disease	No	35	26.9	95	73.1	0.237
	Yes	13	37.1	22	62.9	
Neurological Disease	No	34	25.8	98	74.2	0.060
	Yes	14	42.4	19	57.6	
Solid Organ Tumor	No	43	29.3	104	70.7	0.897
	Yes	5	27.8	13	72.2	
Hematological malignancies	No	48	29.4	115	70.6	0.362
	Yes	0	0.0	2	100.0	
History of immunosuppressive drug use	No	45	30.6	102	69.4	0.219
	Yes	3	16.7	15	83.3	
Surgical operation (within the last 6 months)	No	33	22.6	113	77.4	**< 0.001**
	Yes	15	78.9	4	21.1	
History of transplantation	No	48	29.6	114	70.4	0.263
	Yes	0	0.0	3	100.0	
Total parenteral nutrition	No.	41	28.9	101	71.1	0.878
	Yes	7	30.4	16	69.6	
Central venous catheter	No	2	11.8	15	88.2	0.097
	Yes	46	31.1	102	68.9	
Urinary catheter	No	2	50.0	2	50.0	0.351
	Yes	46	28.6	115	71.4	
Pulmonary embolism	No	46	28.7	114	71.3	0.585
	Yes	2	40.0	3	60.0	
Acute respiratory distress syndrome	No	27	50.0	27	50.0	**< 0.001**
	Yes	13	15.3	72	84.7	
	Unknown	8	30.8	18	69.2	
Sepsis	No	28	42.4	38	57.6	**0.002**
	Yes	20	20.2	79	79.8	
Mechanical ventilation	No	10	40.0	15	60.0	0.192
	Yes	38	27.1	102	72.9	
Broad-spectrum antibiotic use	No	1	12.5	7	87.5	0.290
	Yes	47	29.9	110	70.1	
Corticosteroid use	No	30	53.6	26	46.4	**< 0.001**
	Yes	18	16.5	91	83.5	
Tocilizumab Use	No	47	29.9	110	70.1	0.290
	Yes	1	12.5	7	87.5	
Presence of concurrent bacteremia	No	30	27.5	79	72.5	0.536
	Yes	18	32.1	38	67.9	
Presence of bacteremia before candidemia	No	25	26.6	69	73.4	0.417
	Yes	23	32.4	48	67.6	

Table 2 Risk factors for the development of candidemia according to COVID-19 status

	Non-COVID-19 disease			COVID-19 disease			*P*
	n	Mean ± SD	Median	*n*	Mean ± SD	Median	
Age	48	65 ± 18	71	117	15 ± 56	68	0.608
Duration of central venous catheter	48	49 ± 43	38	117	24 ± 24	18	**0.001**
Duration of antibiotic use (days)	47	24 ± 16	20	116	19 ± 15	14	**0.007**
Duration of corticosteroid use	48	4 ± 6	0	117	30 ± 236	9	**0.001**
Duration of antifungal treatment (days)	36	34 ± 78	13	62	33 ± 85	10	0.250
Duration of hospitalization	48	60 ± 45	52	117	40 ± 53	26	**0.001**
Length of stay in ICU	48	52 ± 46	40	117	25 ± 27	17	**0.001**
Length of stay outside of ICU	48	8.13 ± 15.54	0.00	117	15.06 ± 45.52	2.00	0.060

Table 3 Laboratory results of candidemia patients with and without COVID-19 on the day of the candidemia diagnosis

	Non-COVID-19 disease *n* = 48			COVID-19 disease *n* = 117			
	n	Mean ± SD	Median	*n*	Mean ± SD	Median	*p*
White blood cell (/mm^3)	48	11,333 ± 10,602	9500	117	15,663 ± 9633	13,030	**0.001**
Lymphocyte count (/mm^3)	48	1110 ± 651	1020	117	1363 ± 1476	990	0.752
Platelet count (/mm^3)	48	229,042 ± 146,568	199,000	117	209,396 ± 133,573	201,000	0.445
Hemoglobin (g/dL)	48	9.029 ± 1.466	8.950	116	9.753 ± 2.455	9.500	0.092
Glomerular filtration rate	48	77.999 ± 42.973	88.000	117	63.575 ± 40.10	55.000	**0.050**
Aspartate transaminase (U/L)	48	83.4 ± 242.1	27.0	117	380.3 ± 1252.5	44.0	**0.003**
Alanine transaminase (U/L)	47	50.979 ± 80.876	18.000	117	186.682 ± 490.42	32.000	**0.012**
C-reactive protein (g/L)	48	48.95 ± 68.92	17.86	117	91.24 ± 106.07	34.50	**0.033**
Ferritin (ng/mL)	45	1297.24 ± 2205.01	675.00	115	3793.67 ± 10083.7	1235.00	**0.001**
Lactate dehydrogenase (U/L)	47	379 ± 267	322	103	858 ± 1686	477	**0.001**
D-dimer (mg/L)	44	3.158 ± 3.388	2.450	115	6.407 ± 7.373	3.150	**0.002**

treatment [11]. However, steroids have immunosuppressive effects that increase the risk of Candida infection and worsen the prognosis [1, 12, 13].

In 2004, Tortorano et al. reported candidemia rates ranging from 0.20 to 0.38 per 1000 hospital admissions in a prospective study including seven European countries [14]. The incidence of candidemia has increased 2- to 10-fold during the COVID-19 pandemic because of the use of immunosuppressive drugs to stop the cytokine storm [12, 15–17]. In our study, the incidence of candidemia was 3.6%. The high number of patients infected with COVID-19 in this study also increased the incidence of candidemia.

A study comparing candidemia patients with and without COVID-19 infection reported higher rates of septic shock, total parenteral nutrition, central venous catheter use, corticosteroid therapy, and previous ICU admission in COVID-19 patients [18]. The presence of comorbidities, sepsis, ARDS and corticosteroid use were also found to be significantly greater in COVID-19 patients in our study.

Machado et al. [18] reported that COVID-19 infection rates were higher in patients hospitalized in the ICU and internal medicine clinic prior to the development of candidemia. However, there was no significant difference among patients hospitalized in surgical clinics. Additionally, patients without COVID-19 infection are more likely to have a history of gastrointestinal disease, liver disease, or abdominal surgery [18]. Our study revealed that the rate of COVID-19 positivity was significantly greater in patients admitted to the ICU from internal medicine clinics or after emergency admission than in those admitted from surgical clinics. Additionally, COVID-19 patients had a lower rate of surgical operation history. This finding is likely due to the impact of the COVID-19 pandemic. During the pandemic, hospitals postponed elective operations except for life-threatening emergencies. Physicians in all clinics support the treatment and follow-up of COVID-19 patients [19, 20]. Delaying elective operations for patients with COVID-19 infection reduce pulmonary complications and mortality [21].

In our study, several laboratory tests were more common in COVID-19 patients than in uninfected patients. The leukocyte count was significantly greater in patients with COVID-19 than in those without COVID-19. A high leukocyte count may be related to the prognosis of COVID-19 infection and may also

Table 4 Comparison of risk parameters among survivors and nonsurvivors

		Survivors (*n*:25)		Nonsurvivors (*n*:140)		*P* value
		n	%	*n*	%	
Gender	Female	12	15.2	67	84.8	0.989
	Male	13	15.1	73	84.9	
COVID-19 disease	No	14	29.2	34	70.8	**0.001**
	Yes	11	9.4	106	90.6	
Clinical follow-up before intensive care unit	No	7	9.3	68	90.7	0.063
	Surgery	4	33.3	8	66.7	
	Internal	14	17.9	64	82.1	
Presence of comorbidity	No	13	26.5	36	73.5	**0.008**
	Yes	12	10.3	104	89.7	
Diabetes mellitus	No	23	17.4	109	82.6	0.103
	Yes	2	6.1	31	93.9	
Chronic renal failure	No	25	17.7	116	82.3	**0.025**
	Yes	0	0	24	100	
Hemodialysis	No	24	16.1	125	83.9	0.296
	Yes	1	6.3	15	93.8	
Chronic lung Disease	No	21	16.2	109	83.8	0.489
	Yes	4	11.4	31	88.6	
Neurological disease	No	23	17.4	109	82.6	0.103
	Yes	2	6.1	31	93.9	
Solid organ tumor	No	24	16.3	123	83.7	0.229
	Yes	1	5.6	17	94.4	
Hematologic malignancy	No	25	15.3	138	84.7	0.548
	Yes	0	0	2	100	
Immunosuppressive drug use	No	25	17	122	83	0.058
	Yes	0	0	18	100	
History of surgical operation (within the last 6 months)	No	22	15.1	124	84.9	0.934
	Yes	3	15.8	16	84.2	
Transplantation	No	24	14.8	138	85.2	0.375
	Yes	1	33.3	2	66.7	
ARDS	No	12	22.2	42	77.8	**0.010**
	Yes	6	7.1	79	92.9	
	Unknown	7	26.9	19	73.1	
Sepsis	No	15	22.7	51	77.3	**0.027**
	Yes	10	10.1	89	89.9	
Mechanical ventilation	No	7	28	18	72	**0.050**
	Yes	18	12.9	122	87.1	
Total parenteral nutrition	No	24	16.9	118	83.1	0.119
	Yes	1	4.3	22	95.7	
Central venous catheter	No	3	17.6	14	82.4	0.762
	Yes	22	14.9	126	85.1	
Broad-spectrum antibiotics use	No	0	0	8	100	0.220
	Yes	25	15.9	132	84.1	
Corticosteroid use	No	14	25	42	75	**0.011**
	Yes	11	10.1	98	89.9	
Antifungal treatment initiation	No	8	11.4	62	88.6	0.252

be associated with steroid use [22, 23]. In COVID-19 patients, elevated liver enzyme levels are associated with inflammation and liver damage, which may weaken the immune system and increase the risk of candidemia [24]. Additionally, this relationship may be influenced by the use of corticosteroids in COVID-19 treatment. Therefore, elevated liver enzymes could serve as important markers for the development of candidemia. In cases of candidemia, in addition to heart and eye involvement, liver and spleen involvement may also occur [25]. In our study, no patients were diagnosed with hepatosplenic candidiasis.

Table 5 Multivariate regression analysis of the risk factors for mortality

	OR	95% CI for OR		*P*
		Lower	Upper	
Presence of comorbidity (Yes/No)	4.550	1.109	18.672	**0.035**
Corticosteroid use (Yes/No)	6.530	1.613	26.431	**0.009**
Age	1.039	0.999	1.081	**0.050**
Lymphocyte count	0.999	0.999	1.000	**0.008**
Ferritin level	1.001	1.000	1.002	**0.004**
D-dimer level	1.178	0.980	1.417	**0.050**
Constant	0.004			**0.006**

CI: Confidence interval

However, liver enzyme levels are elevated in patients without COVID-19. Given the many potential causes of elevated liver enzymes in intensive care unit patients, this increase should not be directly attributed to candidemia. Nonetheless, our study revealed that liver enzyme levels were elevated in both COVID-19 patients and non-COVID-19 patients, and the difference between these groups was statistically significant.

CRP, ferritin, LDH and D-dimer tests have prognostic value and are used during follow-up in patients with COVID-19 [23, 26, 27]. A study conducted by Beştepe et al. reported that elevated LDH levels were associated with candidemia in patients with severe COVID-19 [28]. In patients admitted to ICU, elevated CRP levels can serve as a predictive marker for candidemia [29]. In the study by Özmerdiven et al., which examined COVID-19-positive and negative patients, CRP levels were significantly greater in patients with COVID-19. Although ferritin and D-dimer levels are also increased in COVID-19 patients, no statistically significant elevation was observed [30]. We found that these levels were elevated in COVID-19 patients and that ferritin and D-dimer levels were significantly greater in patients with candidemia and a fatal outcome.

In critically ill patients with COVID-19, *C. albicans* is the most commonly isolated yeast species in most studies [31]. In our study, *C. albicans* was isolated in 49% of cases and was identified as the most frequent cause of candidemia. Dixit D et al. reported that the most common causative agent was *C. albicans* in 52.7% of 91 patients with COVID-19 and candida infection, and Nucci M et al. reported that the causative agent was *C. albicans* in 41.5% of patients [17, 32]. The prevalence of candidemia without COVID-19 disease in intensive care unit patients reported by Williams et al. was 0.99%, and the most commonly isolated *Candida* species was nonalbicans *Candida* [33].

The prevalence of candiduria in candidemia patients has been reported to range from 8%-44.5% in various studies [1, 34, 35]. In these studies, the prevalence of candiduria was 35.2%. The presence of diabetes mellitus, malignancy, broad-spectrum antibiotic use, nephrostomy and urinary catheters are important risk factors that play a role in the development of candiduria [36]. Candiduria may be a precursor to candidemia. In cases where *Candida* in the urinary tract spreads to the kidneys by the ascending route, especially in immunosuppressed people [37]. It was reported that patients who develop candidemia as a result of candiduria had lower mortality rates than patients who develop candidemia outside the urinary system did [34]. Similar to other studies, no effect of candiduria on mortality was observed in our study.

The retrospective nature of our study was considered a limitation. The COVID-19 pandemic has caused widespread destruction, resulting in the loss of approximately seven million lives worldwide [32]. The increase in COVID-19 patients during each wave resulted in an increase in the number of ICU beds. This condition has made it challenging to plan prospective studies during the pandemic. The lack of molecular analysis of *Candida* spp was considered as another limitation of the study.

Conclusions

Candidemia is a serious complication, especially in individuals receiving intensive care. This study revealed that mortality rates were higher among candidemic patients who were elderly, had comorbidities, were receiving corticosteroid treatment, and presented elevated ferritin and D-dimer levels. However, owing to the immunosuppressive properties of corticosteroids, there is a significant risk of developing candidemia. Therefore, patients receiving corticosteroids

Table 6 Antifungal susceptibility results for *Candida* species

	Isolate *n* (%)	Fluconazole (%)	Amphotericin B (%)	Anidulafungin (%)	Caspofungin (%)	Mikafungin (%)
C. albicans	81 (49.1)	100	98.5	100	100	97.1
C. parapsilosis	49 (29.8)	77.5	100	100	100	100
C. tropicalis	20 (12.1)	100	100	100	100	100
C. glabrata	7 (4.2)	50	100	100	100	100
C. kefyr	4 (2.4)	100	100	100	100	100
C. inconspicua	1 (0.6)	0	100	NA	100	100

should be closely monitored for potential candidemia. Additionally, elevated ferritin and D-dimer levels should be considered as potential indicators of increased mortality risk in these patients.

Abbreviations

ALT	Alanine Aminotransferase
ARDS	Acute respiratory distress syndrome
AST	Aspartate transferase
COVID-19	Coronavirus Disease caused by SARS-CoV-2 virus
CRP	C- reactive protein
CVCs	Central venous catheters
ICU	Intensive care unit
LDH	Lactate dehydrogenase
PCR	Polymerase Chain Reaction
TPN	Total parenteral nutrition

Author contributions

Yılmaz Karadag F and Öztürk Engin D contributed equally to research design, data collection, writing, and manuscript review. Büber AA, Görmüş T, Arslan E, Şabablı Çetin A, Tekin S, Sayan İ, Bayri C, Odabaşı H and Bakan N were responsible for data collection and manuscript review before submission. Ankaralı H performed the formal analysis and manuscript preparation. All authors have read and approved the manuscript.

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Data availability

The raw data set will be shared with the editor if requested. For those interested in obtaining the study´s raw data for academic purporses, please contact the corresponding author, Fatma Yılmaz Karadağ, at dr_fatma@hotmail.com.Data is provided within related files.

Declarations

Ethics approval and consent to participate

The study was approved by the Sancaktepe Şehit Prof. Dr. İlhan Varan Training and Research Hospital ethics committee (2021/254). All procedures were carried out in conformity with the necessary standards. Permission to use the data in this study was given by the Anesthesiology and Reanimation Clinic.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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