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Original Research Article

Epidemiology of Candidemia: Experience of the Parasitology-Mycology Laboratory at CHU Mohamed VI of Marrakech, Morocco

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Abstract: ***Introduction:*** Candidemia is a bloodstream fungal infection caused by Candida species, whether *albicans* or non-*albicans*. The aim of this article is to determine the epidemiological profile and spectrum of candidiasis. ***Materials and Methods:*** This is a retrospective study conducted over a period of 3 years and 5 months, from February 2021 to July 2024, using computerized data from the parasitology-mycology laboratory of CHU Med VI. The study included 80 positive fungal blood cultures for *Candida*, submitted for mycological analysis, from hospitalized patients who underwent fungal blood culture. ***Results:*** Among the 80 fungal blood cultures recorded for candidemia, *C. tropicalis* was the most frequently isolated species in 35% of cases, followed by *Candida parapsilosis* (30%), *Candida albicans* (17.5%), *Candida glabrata* (10%), *Candida krusei* (5%), and *Candida famata* (2.5%). (Figure 1). The proportion of *C. albicans* versus non-*albicans Candida* was 17.5% vs 82.5%. ***Conclusion:*** Non-*albicans Candida* species are increasingly frequent, with the emergence of new species. Their varying susceptibility to antifungal agents makes species identification essential for patient management.

Keywords: Candidiasis, *Candida albicans*, non-*albicans Candida*, yeasts.

INTRODUCTION

Candidemia is defined as a serious invasive fungal infection, identified by the presence of at least one positive blood culture for *Candida* spp [1]. These opportunistic infections occur mainly in hospitalized patients with multiple risk factors, often in the context of healthcare-associated infections [2]. In recent years, the incidence of candidemia has increased fivefold [3]. In Europe, candidemia accounts for 2 to 3% of septicemia cases and is the third leading cause of septic shock in intensive care units in France. In the United States, *Candida* spp. is the fourth most frequently isolated pathogen in blood cultures performed in the context of nosocomial infections [4,5].

The epidemiological profile of candidemia is evolving worldwide. Although *Candida albicans* remains the most frequently isolated species, its prevalence is decreasing in favor of non-*albicans Candida* species, some of which show reduced susceptibility to antifungal agents [6]. In Morocco, an increase in diagnosed cases has been observed in recent years, with the emergence of new species responsible for candidemia, while the available antifungal options remain limited.

The aim of our study is to assess the frequency of candidemia and describe its epidemiology at the CHU Mohamed VI of Marrakech.

MATERIALS AND METHODS

Type and setting of the study: This study is a cross-sectional retrospective investigation carried out within the Parasitology and Mycology Department of the Arrazi Hospital at CHU Mohamed VI. It includes all hospitalized patients from various departments of this hospital in Marrakech who had a total of 80 blood cultures positive for *Candida*.

Study duration: The study was conducted over a period of 3 years and 5 months, from February 2021 to July 2024.

Inclusion criteria: All patients with blood cultures positive for *Candida* during the study period and hospitalized in the various departments of Arrazi Hospital at CHU Mohamed VI were included.

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Exclusion criteria: Excluded from the study were:

- Patients with negative blood cultures.
- Patients with positive blood cultures for bacteria or fungal species other than *Candida*.

Data collection: Data was collected from the database of the Parasitology-Mycology Department and from the medical records of patients admitted to the various departments of Arrazi Hospital, CHU Mohamed VI in Marrakech.

Data analysis: We used Microsoft Excel 2016 for statistical data analysis. The data were converted into percentages, means, or medians.

Diagnostic approach for yeast detection:

- Samples were collected whenever possible before the administration of antifungal treatment. The samples, taken via venipuncture, were inoculated into Mycosis IC/F® bottles and incubated for 10 days at 35 ± 2°C in the BACTEC 9050 automated system.
- Each bottle detected as positive by the system was processed immediately. A direct microscopic examination was performed to detect fungal elements, and systematic subcultures were carried out on Sabouraud-Chloramphenicol medium incubated at 35 ± 2°C, regardless of the direct examination results.
- Yeast identification was performed using the VITEK® 2 COMPACT system. The susceptibility of *Candida* strains to antifungal agents was assessed using the dilution method on VITEK® 2 COMPACT, testing five antifungals (Fluconazole, Voriconazole, Caspofungin, Micafungin, 5-Fluorocytosine, and Amphotericin B).

Ethical approval: Verbal informed consent was obtained from patients before enrollment in the study. No ethical approval was required for the analysis of the data set, as it contains no personally identifiable information.

RESULTS

During the study period, a total of 2,556 blood cultures were submitted to the parasitology-mycology laboratory.

Among these blood cultures, 80 were positive for *Candida*, representing a positivity rate of 3.3%.

The demographic data in our study showed the following:

- The average age was 34.5 years, with a range from 10 to 67 years.
- The sex ratio (M/F) was 1.

Candidemia cases were primarily reported in the following hospital departments:

- Hematology (35%)
- Pediatric hemato-oncology (15%)
- Intensive care (30%)
- Infectious diseases (12.5%)
- Cardiovascular surgery (5%)
- Oncology (2.5%)

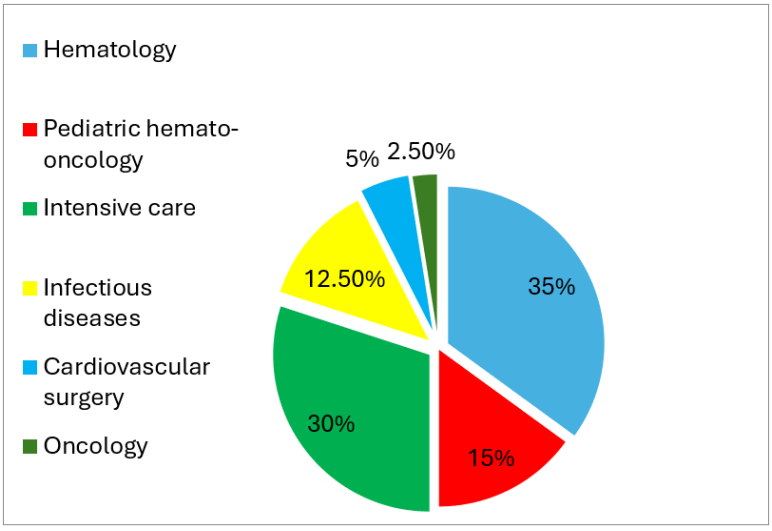

Figure 1: Distribution of candidemia cases by hospital department

Regarding species distribution:

- *Candida tropicalis* was the most frequently isolated species (35%)
- Followed by *Candida parapsilosis* (30%)
- *Candida albicans* (17.5%)
- *Candida glabrata* (10%)
- *Candida krusei* (5%)
- *Candida famata* (2.5%)

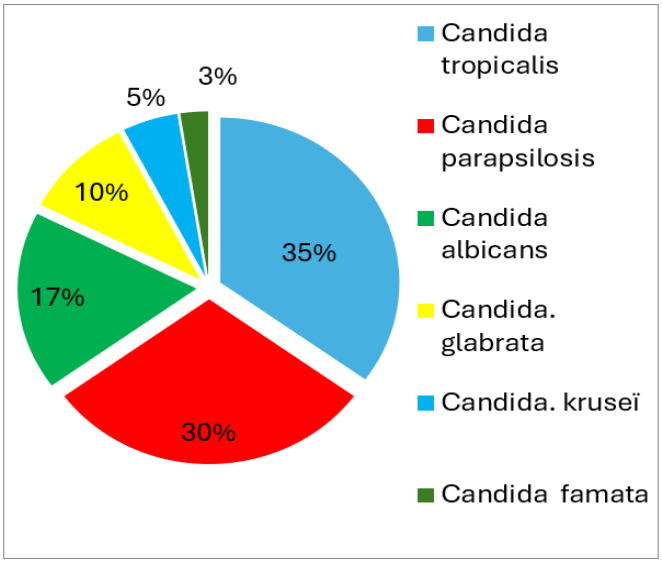

Figure 2: Distribution of isolated Candida species

The proportion of candidemia caused by *C. albicans* versus non-*albicans Candida* was 17.5% vs 82.5%, respectively.

Empirical antifungal therapy: This study showed that all patients received empirical intravenous fluconazole treatment based on clinical suspicion of candidemia.

Antifungal susceptibility:

- All isolated strains were 100% susceptible to amphotericin B and echinocandins,
- 99% susceptible to fluconazole.

DISCUSSION

Invasive candidiasis represents a significant cause of morbidity and mortality worldwide, and its frequency is increasing among hospitalized patients. The attributable mortality of candidemia—that is, the proportion of deaths directly linked to this infection—is estimated to range between 30% and 40% [7]. In intensive care units, these infections account for 17% of acquired infections [8] and are ranked fourth among healthcare-associated infections (10 to 15%) [8].

The emergence of *Candida* spp. as a causative agent of invasive infections dates back to the 1950s [9,10]. Today, *Candida* spp. is considered by many authors to be the fourth most frequently isolated pathogen in nosocomial bloodstream infections [11,12]. Over time, the distribution of *Candida* species has shifted, with an increase in infections caused by non-*albicans* species such as *C. parapsilosis*, *C. tropicalis*, *C. glabrata*, and *C. krusei* [13]. The distribution of *Candida* species varies between countries, regions, hospitals, and even between departments within the same institution.

Currently, 90% of invasive candidiasis cases are mainly caused by five species: *C. albicans*, *C. tropicalis*, *C. glabrata*, *C. parapsilosis*, and *C. krusei*.

During the study period, *C. tropicalis* was the most frequently isolated species, representing 35% of cases. *C. albicans* accounted for 17.5%, while non-*albicans* species represented 82.5% of the isolates. Many studies in the literature provide similar data and emphasize the growing importance of candidemia caused by non-*albicans Candida* species [5, 9, 11, 14, 15].

In our study, *C. parapsilosis*, *C. albicans*, and *C. glabrata* were respectively the second, third, and fourth most frequently isolated species. However, these results differ slightly from several European and African studies, which reported a predominance of *C. albicans*, followed by *C. tropicalis*, *C. parapsilosis*, and *C. glabrata* [5, 21].

Furthermore, other studies from major international surveillance programs on invasive candidiasis have found *C. glabrata* to be the second most common species, just after *C. albicans* [11, 19, 20], whereas in our study, it accounted for only 10% of isolates. Additionally, in our series, *C. krusei* represented 5% of the isolates— a percentage consistent with literature reports, as this species is rarely responsible for invasive candidiasis [19].

The increased isolation of *C. glabrata* and *C. krusei* strains may be linked to aggressive treatments and weakened immune systems in patients—particularly those in intensive care or hematology—as well as the selection pressure caused by antifungal agents used therapeutically or prophylactically.

The antifungal susceptibility profile can vary significantly depending on the *Candida* species and the antifungal class used. Some species may be resistant or have reduced susceptibility to multiple classes of antifungal agents, leading to delayed administration of appropriate therapy [19].

Among non-*albicans Candida* species:

- *C. glabrata* shows reduced susceptibility to azoles,
- *C. parapsilosis* to echinocandins,
- *C. krusei* is naturally resistant to fluconazole.

In our study, although the isolated strains were mostly susceptible, one strain of *C. albicans* showed intermediate susceptibility to fluconazole in a patient with a prior history of fluconazole use.

CONCLUSION

Candida spp. is a frequent cause of nosocomial bloodstream infections, with an epidemiology that varies from country to country. *C. albicans* remains by far the most commonly implicated fungal species, but non-*albicans Candida* species—often less susceptible to antifungal agents—are on the rise.

It is crucial to regularly monitor the epidemiology of candidemia at all levels. Such surveillance allows for understanding the distribution of species, detecting epidemiological and susceptibility shifts, and effectively adjusting treatment strategies to improve patient outcomes.

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