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Original Research Article

Study of Species Distribution and Antifungal Susceptibility of Candida Isolates from Bloodstream Infection in the ICU of a Tertiary Care Hospital of Rajasthan

Shalini Gupta[1], Taruna Swami[2], Supriya Rajvi[3], Amit Rawal[4]

[1]Resident Doctor, Microbiology, Sardar Patel Medical College, Bikaner, Rajasthan, India
[2]Professor & HOD, Microbiology, Sardar Patel Medical College, Bikaner, Rajasthan, India
[3]Assistant Professor, Microbiology, Sardar Patel Medical College, Bikaner, Rajasthan, India
[4]Senior Demonstrator, Microbiology, Sardar Patel Medical College, Bikaner, Rajasthan, India

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Corresponding Author: Dr. Shalini Gupta
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Abstract:

Introduction: Candida bloodstream infections (candidemia) are an important cause of healthcare-associated infections in intensive care units (ICUs), contributing to significant morbidity, mortality, prolonged hospitalization, and increased healthcare costs. The increasing predominance of non-Candida albicans species and the emergence of antifungal resistance have made early species identification and antifungal susceptibility testing essential for effective patient management.

Materials and Methods: A cross-sectional study was conducted in which 240 blood culture samples were collected from patients admitted to various ICUs over an 8 month period (from October 2025 to May 2026), were processed for isolation and identification of Candida species using conventional microbiological methods, CHROMagar Candida, cornmeal agar morphology, germ tube test, and confirmation by the VITEK 2 Compact system. Antifungal susceptibility testing was performed by the Kirby–Bauer disk diffusion method following CLSI guidelines.

Results: Among the 240 blood culture samples, 27 (11.3%) yielded Candida species. Non-Candida albicans species accounted for 77.7% of isolates, while Candida albicans comprised 22.3%. Amphotericin B demonstrated the highest susceptibility (81.4%), followed by nystatin (62.96%), whereas fluconazole showed the lowest susceptibility (33.33%).

Conclusion: The study demonstrates a shift towards predominance of non-albicans Candida species with increasing resistance to azole antifungal agents among ICU patients. Early diagnosis, species-level identification, and routine antifungal susceptibility testing are essential for timely initiation of appropriate therapy, optimizing patient outcomes, and reducing the morbidity and mortality associated with candidemia.

Keywords: Candida bloodstream infection; candidemia; Candida tropicalis; antifungal susceptibility; fluconazole resistance; non-Candida albicans.

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Introduction

Candida species are commensal yeasts that colonize the skin, gastrointestinal tract, genitourinary tract, and mucosal surfaces of healthy individuals. Under conditions of impaired host immunity or disruption of normal microbial flora, these opportunistic fungi can invade the bloodstream and disseminate to multiple organs, resulting in invasive candidiasis. The incidence of candidemia has increased steadily over the past few decades and currently represents one of the most common causes of nosocomial bloodstream infections worldwide. [1,2]

Although Candida albicans has traditionally been the predominant cause of invasive Candida infections. There has been a gradual epidemiological shift toward non-albicans candida (NAC) species in recent years. This changing epidemiology is clinically important because different Candida species exhibit varying antifungal susceptibility profiles. [3,4] Several non-Candida albicans species possess intrinsic or acquired resistance to commonly used azole antifungal agents. [5]

The risk factors for Candida bloodstream infection (BSI) include ICU admission with prolonged hospital stay, central venous line insertion, urinary catheterization, antibiotic overuse, diabetes mellitus, immunosuppression. [6,7]

There are different laboratory methods for identification of the various Candida species. Conventional identification methods, including germ tube testing, CHROMagar Candida, cornmeal agar morphology, carbohydrate assimilation tests, and automated identification systems such as the VITEK 2 Compact, improve diagnostic accuracy and facilitate timely clinical management.

Materials and Methods

Study Design and Setting: A cross-sectional observational study was performed in the Department of Microbiology, S.P. Medical College, Bikaner, Rajasthan, over a period of eight months (from October 2025 to May 2026). Under aseptic conditions, Blood culture samples were collected from patients admitted to various ICUs.

Identification of Candida Species: Blood samples were inoculated into BacT/ALERT blood culture bottles and incubated at 37°C. Positive blood culture bottles were subcultured onto Blood agar and MacConkey agar using the streak plate method followed by incubation at 37°C for 24 hours. Gram staining was performed directly from the positive blood culture broth and from the isolated colonies.

Species identification was performed using a combination of conventional methods and an automated identification system. Identification included Gram staining, germ tube test, colony morphology on CHROMagar Candida, and microscopic morphology on cornmeal agar with Tween 80. Final species confirmation was carried out using the VITEK 2 Compact automated identification system.

Antifungal Susceptibility Testing: Antifungal susceptibility testing was performed by the Kirby–Bauer disk diffusion method on Mueller–Hinton agar supplemented with 2% glucose and 0.5 µg/mL methylene blue in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines. The antifungal agents tested included fluconazole, ketoconazole, itraconazole, amphotericin B, and nystatin. Zone diameters were interpreted according to CLSI breakpoints.

Results

A total of 240 blood culture samples from ICU patients with suspected bloodstream infection were processed during the study period. Candida species were isolated from 27 (11.3%) samples, while the remaining 213 (88.7%) samples were negative for Candida.

Out of the 27 patients with candidemia, 17 (62.96%) were males and 10 (37.04%) were females. The highest number of cases was observed in the 0–10 years age group (37.0%), followed by the 51–60 years age group, indicating that both paediatric and elderly ICU patients were at increased risk of candidemia.

Among the 27 Candida isolates, Candida tropicalis 11 (40.7%) was the most common species, followed by Candida albicans 6 (22.2%), Candida krusei 5 (18.5%), Candida parapsilosis 3 (11.1%), and Candida glabrata 2 (7.4%). (Table 1 and Fig :1). Non-Candida albicans species predominated, accounting for 21 (77.8%) isolates, whereas Candida albicans constituted 6 (22.2%) isolates. Thus, Candida tropicalis was the predominant bloodstream isolate among ICU patients.

The most frequently identified risk factors were prior use of broad-spectrum antibiotics (85.2%) and urinary catheterization (85.2%), followed by prolonged ICU stay (77.8%), recent surgery (59.3%), central venous catheterization (48.1%), corticosteroid therapy (44.4%), diabetes mellitus (33.3%), and total parenteral nutrition (25.9%).

Antifungal susceptibility testing demonstrated that amphotericin B showed the highest in vitro susceptibility (81.4%), followed by nystatin (62.96%). In contrast, fluconazole exhibited the lowest susceptibility (33.33%), indicating reduced susceptibility among Candida bloodstream isolates. Variable susceptibility was observed with itraconazole and ketoconazole. (Table 2 and Fig :2)

Table 1: Distribution of Candida species isolated from bloodstream infections (n=27)

Candida Species	Number of Isolates	Percentage
Candida albicans	06	22.2%
Candida tropicalis	11	40.7%
Candida krusei	05	18.5%
Candida parapsilosis	03	11.1%
Candida glabrata	02	7.4%

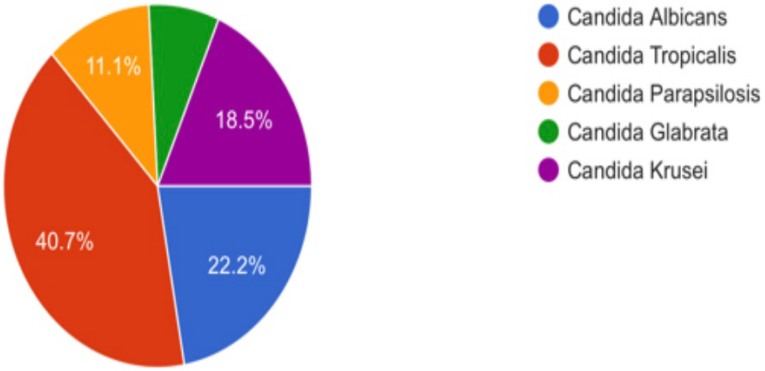

Figure 1: Candida Species Distribution

Table 2: Antifungal Susceptibility pattern among Candida Species isolates by Kirby-Bauer disc diffusion method

Drugs	Sensitivity (%)	Intermediate(%)	Resistance(%)
Fluconazole	33.33%	18.51%	48.14%
Ketoconazole	55.55%	25.92%	18.51%
Itraconazole	37.03%	48.14%	14.81%
Amphotericin B	81.4%	7.4%	11.11%
Nystatin	62.96%	25.92%	11.11%

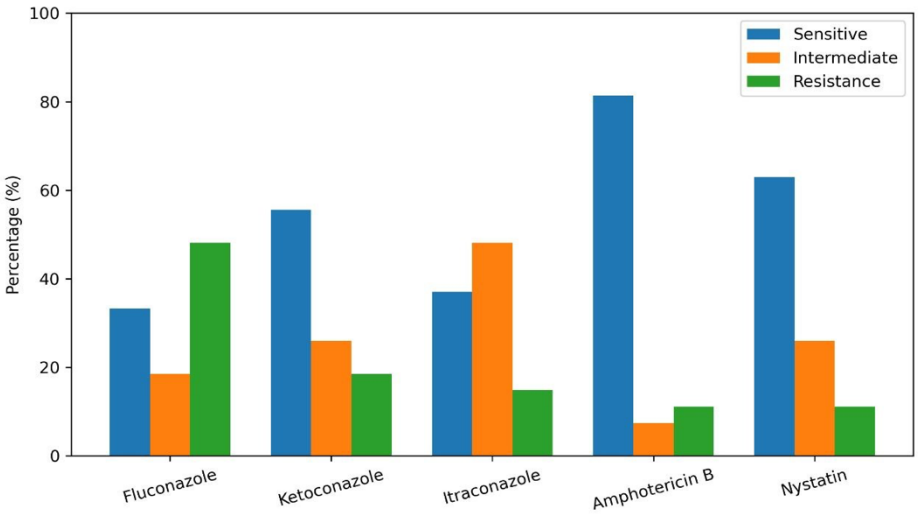

Figure 2: Antifungal Susceptibility pattern among Candida Species

Discussion

Candidemia is a hematogenous infection by the Candida species that predominantly impacts individuals with compromised immune systems, such as those treated with chemotherapy or those diagnosed with HIV/AIDS. Early identification is crucial for proper management and better patient outcomes [8,9]

In the present study, the prevalence of candidemia among blood culture samples was 11.25% (27/240), which is comparable to previous Indian studies Mamta Lamba et al.(16) and Jagdish Chander et al. [15] who found a prevalence rate of 9.94% and 10.06% respectively.

A male predominance (62.1%) was observed, due to increased exposure of male patients to healthcare-associated risk factors such as prolonged ICU stay, invasive devices, broad-spectrum antibiotic therapy, and underlying comorbidities. [14]

The study demonstrated a clear predominance of non-albicans Candida (77.8%) over Candida albicans (22.2%). Among the non-albicans species, Candida tropicalis was the most frequently isolated species (40.7%), These findings are comparable to Jagdish Chander et al. [15], Tejan et al. [12] , R.

Adhikary et al.13 and Mamta Lamba et al. [16] which found 40.8%, 42.1%, 39.7% and 43.75% respectively, followed by Candida krusei, Candida parapsilosis, and Candida glabrata.

Several Indian studies have reported a shift toward non-albicans Candida species. The increasing predominance of C. tropicalis may be associated with prolonged hospitalization, extensive use of broad-spectrum antibiotics, immunosuppressive therapy, invasive procedures, and inadequate infection control practices. [10,11]

The major risk factors identified were urinary catheterization, broad-spectrum antibiotic use, central venous catheterization, steroid therapy, diabetes mellitus. These findings indicate that invasive devices and underlying comorbidities are major predisposing factors for the development of Candidemia. [17]

Antifungal susceptibility testing showed that Amphotericin B (81.4%) was the most effective antifungal agent, whereas Fluconazole exhibited the lowest susceptibility (33.33%). Similar patterns have been reported in R. Adhikary et al. [13], Mamta Lamba et al. [16] reflect the widespread empirical and prolonged use of fluconazole. The increasing resistance among non-albicans Candida species highlights the importance of routine antifungal susceptibility testing to guide appropriate therapy. Intrinsic resistance of Candida krusei to fluconazole and the reduced azole susceptibility of Candida glabrata emphasize the importance of species-level identification before initiating antifungal therapy. [16]

Overall, the findings of the present study confirm the changing epidemiology of candidemia, characterized by the predominance of non-albicans Candida species and increasing azole resistance. These observations emphasize the need for early diagnosis, species-level identification, routine antifungal susceptibility testing, and strict infection control practices to improve patient outcomes and optimize antifungal therapy in ICU settings.

Conclusion

The present study demonstrates that non-albicans Candida species have emerged as the predominant cause of candidemia, with Candida tropicalis being the most frequently isolated species. This changing epidemiological trend highlights the need for routine species-level identification, as different Candida species exhibit distinct antifungal susceptibility profiles that significantly influence therapeutic decisions. Amphotericin B showed the highest susceptibility, while Fluconazole exhibited the lowest susceptibility among Candida species isolates.

References

1. Méan M, Marchetti O, Calandra T. Bench-to-bedside review: Candida infections in the intensive care unit. Crit Care. 2008;12(1):1-9.
2. Wisplinghoff H, et al. Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. Clin Infect Dis. 2004;39(3):309-317.
3. Kullberg BJ, Arendrup MC. Invasive candidiasis. N Engl J Med. 2015;373:1445-1456.
4. Kothalawala M, Jayaweera J, Arunan S, Jayathilake A. The emergence of non-albicans candidemia and evaluation of HiChrome Candida differential agar and VITEK 2 YST platform for differentiation of Candida bloodstream isolates in a teaching hospital in Kandy, Sri Lanka. BMC Microbiol. 2019;19:136.
5. Pfaller MA, Neofytos D, Diekema D, Azie N, Meier-Kriesche HU, Quan SP, et al. Epidemiology and outcomes of candidemia in 3648 patients: data from the prospective Antifungal Therapy (PATH Alliance) registry, 2004-2008. Diagn Microbiol Infect Dis. 2012;74:323-331.
6. Falagas ME, Roussos N, Vardakas KZ. Relative frequency of albicans and the various non-albicans Candida spp among candidemia isolates from inpatients in various parts of the world: a systematic review. Int J Infect Dis. 2010;14(11):e954-e966.
7. Rani R, Mohapatra NP, Mehta G, Randhawa VS. Changing trends of Candida species in neonatal septicaemia in a tertiary north Indian hospital. Indian J Med Microbiol. 2002;20:42-44.
8. Leroy O, Mira JP, Montravers P, et al. Comparison of albicans vs non-albicans candidemia in French intensive care units. Crit Care. 2010;14(3):R98. doi:10.1186/cc9033.
9. Pfaller MA, Messer SA, Moet GJ, et al. Candida bloodstream infections: comparison of species distribution and resistance to echinocandin and azole antifungal agents in intensive care unit (ICU) and non-ICU settings in the SENTRY Antimicrobial Surveillance Program (2008-2009). Int J Antimicrob Agents. 2011;38(1):65-69. doi:10.1016/j.ijantimicag.2011.02.016.
10. Chaudhury N, Majumdar M, Dutta A, et al. Emerging incidence of candidemia in neonatal intensive care unit and sick newborn care unit in a tertiary care hospital of Eastern India. Int J Med Sci Public Health. 2020;3:60-67.

11. Divakar A, Pillai MGK, V AK, Gundam RR. Bloodstream infections with Candida species: a prospective study in a tertiary care center. Int J Med Res Rev. 2017;5:1015-1021.
12. Tejan N, Singla N, Guglani V, et al. Comparison of incidence, risk factors, outcome and antifungal susceptibility between Candida albicans and non-albicans Candida species in patients with candidemia in an intensive care setting. Int J Pharm Sci Res. 2017;8:4891-4898.
13. Adhikary R, Joshi S. Species distribution and antifungal susceptibility of candidemia at a multi super-specialty center in Southern India. Indian J Med Microbiol. 2011;29(3):309-311. doi:10.4103/0255-0857.83920.
14. Giri S, Kindo AJ, Kalyani J. Candidemia in intensive care unit patients: a one-year study from a tertiary care center in South India. J Postgrad Med. 2013;59(3):190-195. doi:10.4103/0022-3859.118036.
15. Chander J, Singla N, Sidhu SK, Gombar S. Epidemiology of Candida bloodstream infections: experience of a tertiary care centre in North India. J Infect Dev Ctries. 2013;7(9):670-675. doi:10.3855/jidc.2623.
16. Lamba M, Sharma D, Sharma R, Vyas A, Mamoria V. Profile of Candida isolates and antifungal susceptibility pattern in neonatal sepsis in a tertiary care hospital of North India. J Matern Fetal Neonatal Med. 2021;34(16):2655-2659. doi:10.1080/14767058.2019.1670799.
17. Gautam G, Rawat D, Kaur R, Nathani M. Candidemia: changing dynamics from a tertiary care hospital in North India. Curr Med Mycol. 2022;8(1):20-25. doi:10.18502/cmm.8.1.9210.