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Clinical and Microbiological Profile of Candidemia: Insights from a Tertiary Care Centre in Eastern Uttar Pradesh

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ABSTRACT

INTRODUCTION: Candidemia is a major cause of invasive fungal bloodstream infections and is associated with significant morbidity and mortality among hospitalized patients, particularly those admitted to intensive care units. The increasing incidence of candidemia has been attributed to prolonged hospitalization, extensive use of broad-spectrum antibiotics, invasive medical procedures, intravascular catheters, and a growing population of immunocompromised and critically ill patients.[12] In recent studies from India have demonstrated a shift toward non-albicans Candida species such as Candida tropicalis, Candida parapsilosis, Candida glabrata, and Candida krusei.[12] This changing epidemiological trend is clinically significant due to differences in pathogenicity, biofilm formation, and antifungal susceptibility patterns among various Candida species. The emergence of antifungal resistance, particularly to azole agents, has further complicated the management of candidemia and emphasizes the need for accurate species-level identification.[12] Early diagnosis and timely initiation of appropriate antifungal therapy are crucial for improving patient outcomes. Blood culture remains the gold standard for diagnosis, while antifungal susceptibility testing plays a key role in guiding targeted therapy. Standardized susceptibility testing methods recommended by the Clinical and Laboratory Standards Institute (CLSI) ensure reliable interpretation of antifungal resistance patterns.[3]

MATERIALS AND METHODS: The present study was designed as a prospective cross-sectional study conducted over a period of one year from January 2024 to December 2024 in the Department of Microbiology, Moti Lal Nehru Medical College. A total of 250 blood samples were included in the study. Blood samples were collected from patients clinically suspected of having bloodstream infections and submitted to the microbiology laboratory for culture and further processing. Standard aseptic precautions were followed during sample collection to minimize contamination. The collected samples were processed according to routine microbiological protocols for the isolation and identification of causative organisms.

RESULT: Candidemia constituted approximately 6–8% of all bloodstream infections in the present study. The majority of cases were observed among intensive care unit (ICU) patients, with a higher incidence noted in neonates and elderly individuals, reflecting their increased vulnerability. Analysis of species distribution revealed that Candida tropicalis was the most frequently isolated species, accounting for 35–40% of cases, followed by Candida albicans (20–25%), Candida parapsilosis (15–20%), and Candida glabrata (10–12%). Other Candida species together contributed to less than 5% of the isolates. Antifungal susceptibility testing demonstrated a fluconazole resistance rate of 25–30%, predominantly among C. glabrata and C. krusei isolates.

In contrast, echinocandins showed high efficacy, with susceptibility rates exceeding 90% across most Candida species.
CONCLUSION: Candidemia is emerging as a significant challenge in tertiary care centres of Eastern Uttar Pradesh, with a clear predominance of non-albicans Candida species. This changing epidemiological trend has important therapeutic implications, as many non-albicans species exhibit reduced susceptibility or resistance to commonly used antifungal agents, particularly fluconazole. The high rate of fluconazole resistance observed in recent studies underscores the necessity for routine species-level identification and antifungal susceptibility testing for all Candida bloodstream isolates. Early diagnosis, appropriate antifungal therapy, and implementation of effective preventive measures, including antifungal stewardship programmes and strict infection control practices, are essential to reduce associated morbidity and mortality.

Keywords: Candidemia, Broad spectrum antibiotic, Immunosuppression, C.albicans.

INTRODUCTION

Candidemia, defined as the presence of Candida species in the bloodstream, is one of the most common causes of invasive fungal infections among hospitalized patients and is associated with substantial morbidity and mortality, particularly in critically ill individuals admitted to intensive care units (ICUs).[12] Over the past few decades, the incidence of candidemia has increased worldwide, largely due to the widespread use of broad-spectrum antibiotics, prolonged hospital stay, invasive diagnostic and therapeutic procedures, central venous catheterization, parenteral nutrition, and the growing use of immunosuppressive therapies.[12] These factors disrupt normal host defenses and facilitate colonization and subsequent bloodstream invasion by Candida species.

Traditionally, *Candida albicans* was regarded as the predominant etiological agent of candidemia. However, recent epidemiological studies from India and other regions have documented a significant shift toward non-albicans Candida (NAC) species.[12] Species such as *Candida tropicalis*, *Candida parapsilosis*, and *Candida glabrata* have emerged as important causes of bloodstream infections. This shift is clinically relevant because NAC species often exhibit reduced susceptibility or intrinsic resistance to commonly used antifungal agents, particularly azoles like fluconazole, thereby complicating therapeutic management.[12] The emergence of antifungal resistance emphasizes the importance of accurate species-level identification and routine antifungal susceptibility testing.

Early diagnosis and timely initiation of appropriate antifungal therapy are crucial determinants of clinical outcome in candidemia. Blood culture remains the gold standard for diagnosis, and antifungal susceptibility testing performed according to standardized guidelines, such as those recommended by the Clinical and Laboratory Standards Institute (CLSI), helps guide targeted therapy and monitor resistance trends.[3] Despite the increasing burden of candidemia in India, epidemiological data from Eastern Uttar Pradesh are scarce. Regional variations in species distribution, risk factors, and antifungal susceptibility patterns necessitate local surveillance. Therefore, the present study was undertaken to analyze the prevalence, associated risk factors, species distribution, antifungal susceptibility patterns, and clinical outcomes of candidemia in patients admitted to a tertiary care hospital in Prayagraj.

AIMS AND OBJECTIVES

1. To determine the prevalence of candidemia among patients with suspected bloodstream infections.
2. To identify the species distribution of Candida isolated from blood cultures.
3. To assess the antifungal susceptibility patterns of Candida isolates using standard guidelines.

MATERIALS AND METHODS

This prospective cross-sectional observational study was conducted in the Department of Microbiology, Moti Lal Nehru Medical College and its associated hospitals, Prayagraj, Eastern Uttar Pradesh, over a period of one year from January 2024 to December 2024. A total of 250 blood samples collected from patients of all age groups who were clinically suspected of having bloodstream infections were included in the study. Patients presenting with clinical features suggestive of sepsis and whose blood cultures yielded growth of Candida species were enrolled. Repeat Candida isolates obtained from the same patient during the study period were excluded to avoid duplication. In addition, blood culture samples that showed growth of organisms other than Candida species were excluded from the study.

IDENTIFICATION OF CANDIDA SPECIES:
Positive blood cultures showing yeast-like cells on Gram staining were subcultured on Sabouraud Dextrose Agar (SDA). Colonies were examined for morphology. Gram staining demonstrated Gram-positive oval budding yeast cells(Figure 1) approximately 4-8µm with or without pseudohyphae. Germ tube test was performed using human serum for differentiation of Candida albicans from non-albicans Candida species.

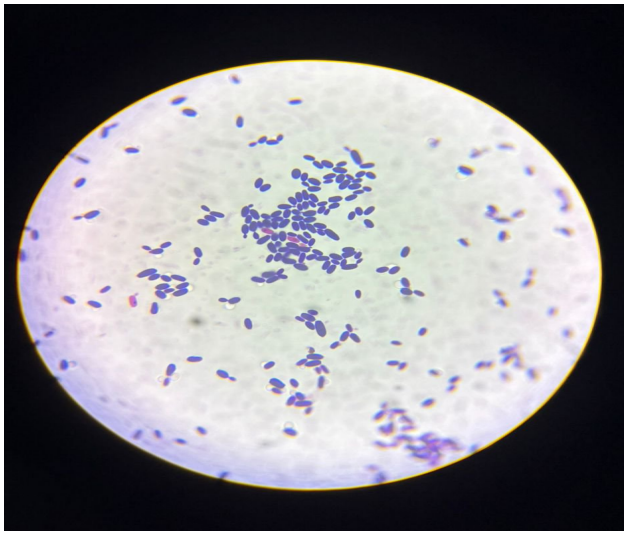


Figure :1

CULTURE
Blood samples were collected aseptically using standard precautions and inoculated into Brain Heart Infusion (BHI) broth or automated blood culture bottles. The cultures were incubated at 37°C for 24 – 48 hours and monitored for growth, the growth on Sabouraud Dextrose Agar appeared as cream-colored, smooth, and pasty colonies. (Figure 2) Since colony morphology alone is insufficient for definitive species identification, a germ tube test was performed to differentiate *Candida albicans* from non-albicans Candida species.

Germ tube test
The germ tube test is a simple and rapid diagnostic method used to differentiate *Candida albicans* from non-albicans Candida species. It is based on the ability of *C. albicans* to produce germ tubes, which are short, tube-like outgrowths from yeast cells, when incubated in human or animal serum at 37°C for 2–3 hours. (Figure 3)

Procedure: A small inoculum of the yeast isolate is added to serum and incubated at 37°C. After incubation, a drop of the suspension is placed on a glass slide and examined under a microscope for the presence of germ tubes. The appearance of filamentous projections without constriction at their base is considered a positive result, indicating *Candida albicans*. Isolates that do not form germ tubes are categorized as non-albicans Candida species, which require further identification using chromogenic agar or biochemical methods.

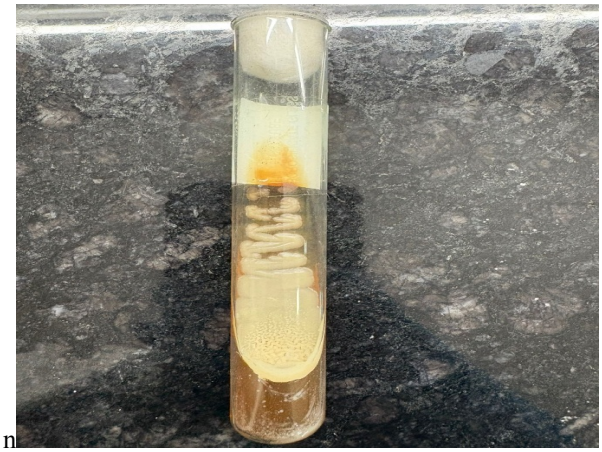
n 

Figure:2

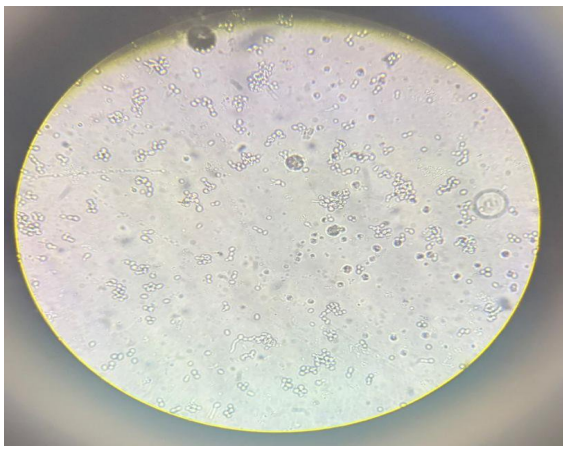


Figure: 3

CHROM AGAR

CHROM agar was used for the simultaneous isolation and presumptive identification of various *Candida* species based on the reaction between species-specific enzymes and chromogenic substrates, resulting in the formation of characteristic coloured colonies. *Candida albicans* produced green-coloured colonies, *Candida parapsilosis* showed brown to yellow colonies, *Candida glabrata* produced white to pink colonies, *Candida krusei* formed pale pink colonies, and *Candida tropicalis* produced metallic blue colonies with a purple halo. Figure 4

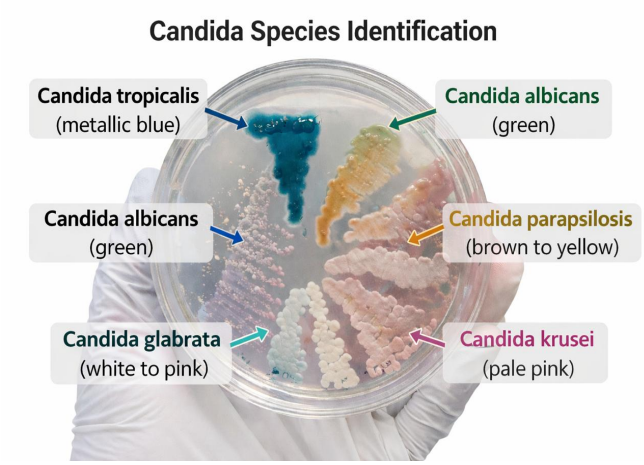


Figure: 4

RESULTS

Out of 250 blood culture samples processed, candidemia accounted for approximately 6–8% of bloodstream infections. (figure 5). The majority of cases were observed in ICU patients, followed by neonates and elderly individuals. (Figure 6). Among the 20 cases of candidemia observed in this study, *Candida tropicalis* was the most frequently isolated species, accounting for approximately 35–40% of cases. This was followed by *Candida albicans*, which contributed to 20–25% of isolates. *Candida parapsilosis* and *Candida glabrata* were less common, representing 15–20% and 10–12% of isolates, respectively. Other Candida species were rare, together accounting for less than 5% of cases. This pattern indicates a clear predominance of non-albicans Candida species in bloodstream infections, with *C. tropicalis* emerging as the most important pathogen in this patient population.

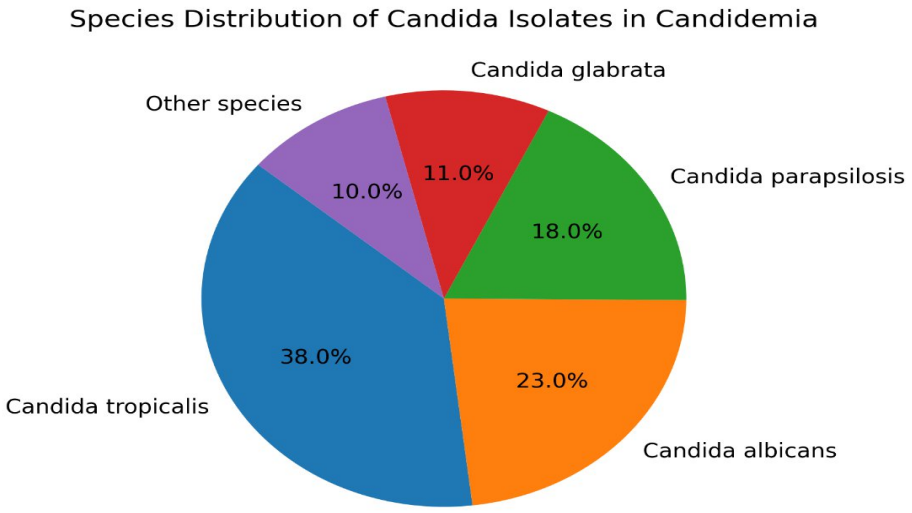


Figure:5

AGE GROUP

The highest number of cases was observed among neonates (<1 year), accounting for 27.3% of the total cases. This was followed by patients in the 21–40 years age group (22.7%) and 41–60 years age group (18.2%). The 1–20 years and 61–80 years age groups each contributed 13.6% of the cases. The lowest prevalence of candidemia was observed in patients aged more than 80 years (4.5%).

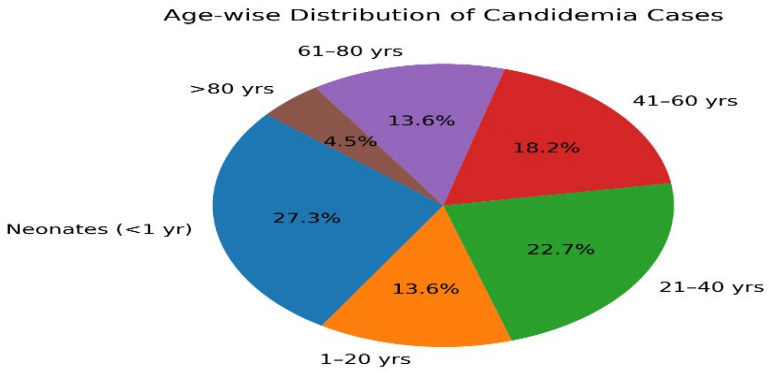


Figure: 6

Age group (years)	**Number %**
<1 (Neonates)	6 (27.3%)
1-20	3 (13.6 %)
21-40	5 (22.7)
41-60	4(18.2)
61-80	3 (13.6)
>80	1 (4.5)
Total	20 (Positive cases)

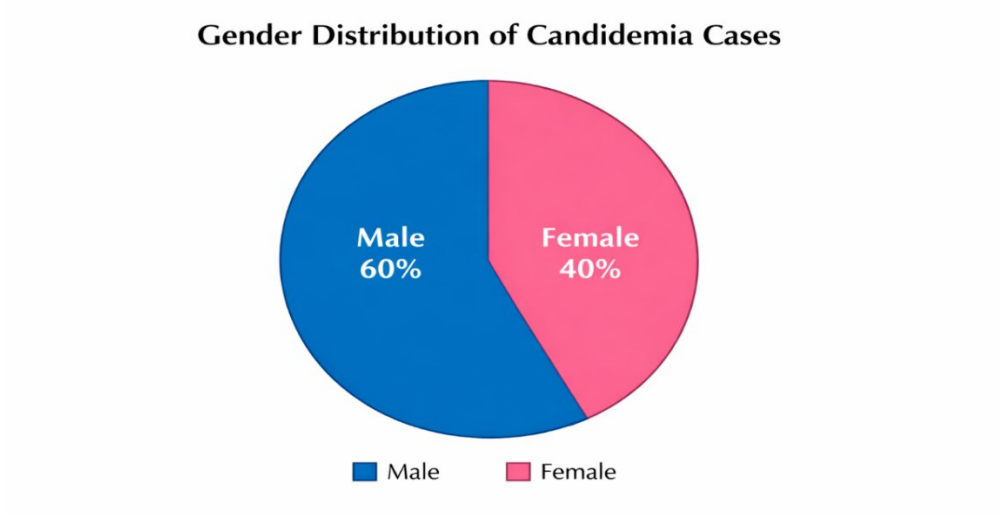


FIGURE: 7

ANTIFUNGAL SUSCEPTIBILITY PATTERN:
Fluconazole resistance was observed in 25–30% of isolates, particularly among Candida glabrata and Candida krusei. Echinocandins showed more than 90% susceptibility across all species. (Figure: 8)

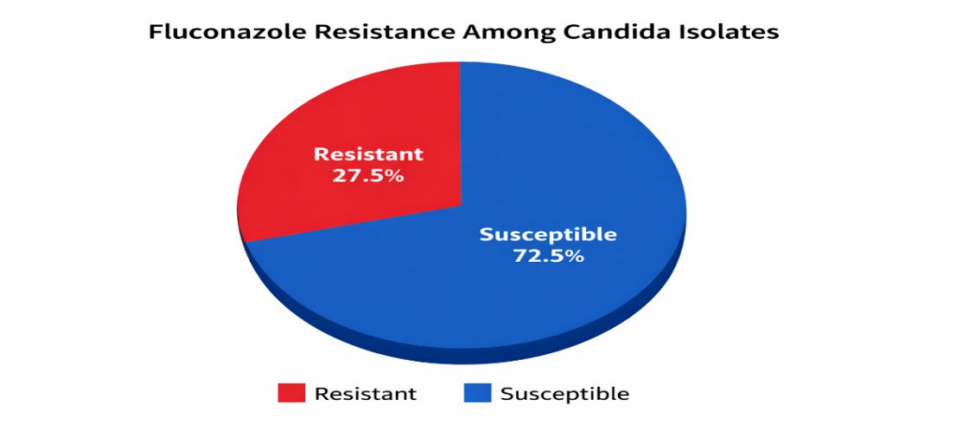


Figure: 8

DISCUSSION

The present study demonstrates that candidemia constituted 6–8% of bloodstream infections among 250 blood culture samples, a finding comparable to reports from Indian tertiary care centers where candidemia accounts for 5–10% of nosocomial bloodstream infections, particularly in intensive care units (ICUs).[1,4] The predominance of ICU patients in this study reinforces the well-established association between candidemia and critical illness, prolonged hospitalization, invasive procedures, broad-spectrum antibiotic use, and immunosuppression.[5,7] The increased burden observed among neonates and elderly patients further highlights the role of immature or declining immunity, consistent with earlier epidemiological observations.[10,11]

A notable finding of the present study is the predominance of non-*albicans Candida* species, with *Candida tropicalis* accounting for 35–40% of isolates. Similar trends have been widely reported from India and other tropical regions, where *C. tropicalis* has emerged as the leading cause of candidemia, surpassing *Candida albicans*.[2,4] This contrasts with earlier Western studies that reported *C. albicans* as the predominant species, indicating a clear epidemiological shift over time.[5,9] The isolation of *C. parapsilosis* (15–20%) and *C. glabrata* (10–12%) in the present study is also in agreement with global data, particularly in patients with intravascular devices and prolonged ICU stay.[6,8]

Age-specific analysis revealed the highest prevalence of candidemia among neonates (<1 year), followed by adults aged 21–40 years and 41–60 years. Neonatal candidemia has been attributed to prematurity, low birth weight, prolonged ICU stay, use of central venous catheters, and parenteral nutrition, while higher rates in adults reflect greater exposure to invasive interventions and underlying comorbidities.[11]The comparatively lower incidence in pediatric and very elderly age groups may reflect smaller sample representation or reduced exposure to high-risk hospital procedures.

Antifungal susceptibility testing revealed fluconazole resistance in 25–30% of isolates, predominantly among *C. glabrata* and *C. krusei*, which is consistent with their known intrinsic or dose-dependent resistance mechanisms.[1,2] In contrast, echinocandins demonstrated excellent activity, with more than 90% susceptibility across all species. This finding aligns with CLSI recommendations and international treatment guidelines, supporting the use of echinocandins as first-line therapy in critically ill and high-risk patients.[3,12]

Overall, the study highlights the growing predominance of non-*albicans Candida*, particularly *C. tropicalis*, the heightened susceptibility of ICU patients and neonates, and the emerging challenge of azole resistance. These findings underscore the importance of early diagnosis, species-level identification, and antifungal susceptibility testing to guide targeted therapy and improve clinical outcomes in patients with candidemia.

CONCLUSION

Candidemia was observed in 6–8% of bloodstream infections, predominantly affecting ICU patients and neonates. Non-albicans Candida species, especially *Candida tropicalis*, were the most common isolates, reflecting a shift from *C. albicans*. Fluconazole resistance was notable in *C. glabrata* and *C. krusei*, whereas echinocandins remained highly effective. Age and critical illness emerged as significant risk factors, underscoring the vulnerability of neonates and ICU patients. These findings highlight the need for early identification of Candida species and antifungal susceptibility testing to guide targeted therapy, reduce morbidity, and improve clinical outcomes in high-risk populations.

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