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To Study the Prevalence of Colonization and Infection by *Candida Species* in Intensive Care Units at Tertiary Care Hospital, India

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Abstract

Fungi, especially *Candida species*, pose significant health risks in ICUs, contributing to increased morbidity and mortality. Candidiasis, particularly candidemia, is concerning in critically ill patients, with a rise in *non-albicans Candida* isolates leading to treatment failures. *Candida auris* presents a serious nosocomial risk, necessitating intensive screening. This study aims to assess the prevalence of *Candida* colonization and infection in ICU settings. Two swabs were collected from each patient—one from skin lesions and one from non-lesion areas. Of the 280 swabs, 81 showed *Candida* growth, with 43 from lesion areas. Prolonged ICU stays and ventilator use were identified as significant risk factors. *Candida* infections are more prevalent in middle-aged to older adults and males, emphasizing the need for infection control measures.

Keywords: *Candida, Colonization*, ICU, Infection

Introduction

In the early 1980s, fungi became a significant public health concern, especially in intensive care units (ICUs) and among immunocompromised patients, due to the rising incidence of fungal infections, which contribute to increased morbidity and mortality. Candidiasis, a major cause of fungal infections in ICUs, is particularly concerning as it leads to prolonged hospital stays, higher medical costs, and increased mortality. Identification of *Candida species* is essential for effective treatment, as species vary in their susceptibility to antifungal agents [1].

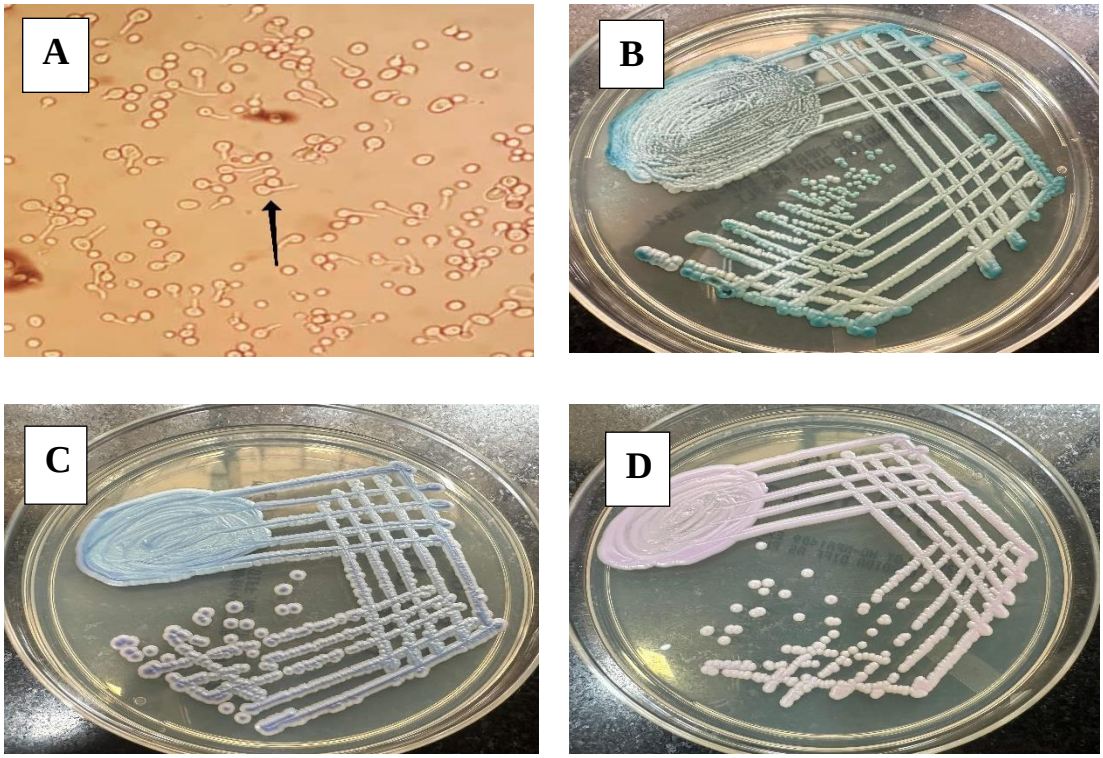
Candidemia, a bloodstream infection caused by *Candida species*, has become an alarming issue in critically ill patients, with a global rise in incidence. Particularly, *non-albicans Candida* (NAC) species, such as *C. glabrata*, *C. tropicalis*, *C. parapsilosis*, and *C. krusei*, are emerging as predominant pathogens in many regions[2]. These NAC species are often associated with resistance to common antifungal treatments, leading to higher rates of treatment failure and posing significant challenges in clinical management[3].

Candida auris, a novel and highly resistant yeast implicated in hospital outbreaks worldwide, is known for its multidrug resistance and ability to persist on surfaces, leading to rapid nosocomial transmission and necessitating intensive infection control measures, including comprehensive screening and isolation protocols, to prevent its spread in healthcare settings [4].

Symptoms of invasive *Candida* infections, such as persistent fever and chills, can often be indistinguishable from other medical conditions, complicating diagnosis and delaying treatment. In critically ill patients, early detection and species identification are vital to guiding appropriate therapy and improving outcomes [5]. Understanding the epidemiology, risk factors, and pathophysiology of *Candida*infections is essential to developing effective strategies for prevention and treatment, ultimately reducing the associated mortality and healthcare burden[6].In light of these challenges, a study was conducted to assess the prevalence of colonization and infection by *Candida species* in ICU settings at a tertiary care hospital, with the goal of improving management strategies and patient outcomes.

Material and method

A total of 140 ICU patients were screened for *Candida* infections using skin swabs, both with and without lesions, processed through microscopic, cultural, and biochemical techniques. Microscopic examination involved potassium hydroxide (KOH) mounts and Gram staining for yeast visualization. Samples were cultured on Sabouraud's Dextrose Agar (SDA) to isolate *Candida species,* with the germ tube test (Fig.1-A) identifying *Candida albicans* (Fig.1-B) and carbohydrate assimilation tests differentiating *non-albicans Candida* (NAC). Chromogenic agar was also used for rapid species identification. The results revealed diverse *Candida species*, highlighting the need for tailored infection control measures due to varying antifungal resistance patterns, emphasizing ongoing monitoring to reduce risks and improve patient outcomes.



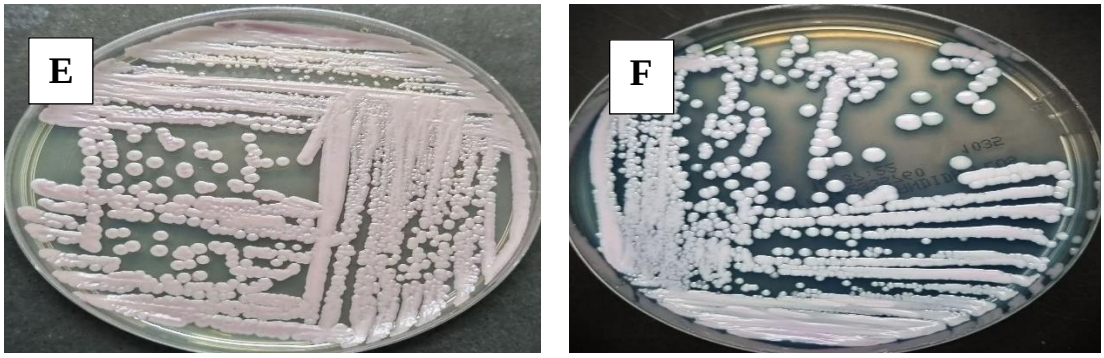


Fig.1- A- Germ tube formation, B-*Candida albicans* C- *Candida tropicalis*, D-*Candida krusei*, E-*Candida parapsilosis*, F-*Candida glabrata*

Results:

Table 1: Distribution of patients in Intensive care units. (n=140)

ICU	No. of patients	Percentage (%)
MICU	98	70%
SICU	42	30%
TOTAL	140	100%

Fig2: Distribution of patients in Intensive care units. (n=140)

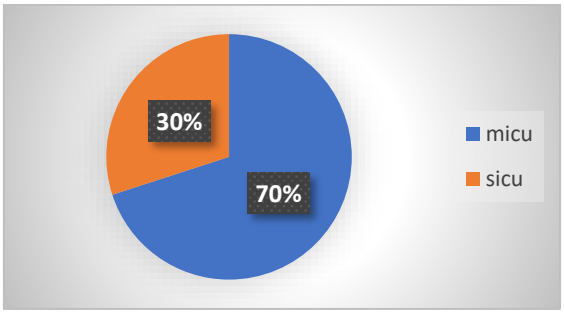


Table 2: Age-wise Distribution of patients in ICU. (n=140)

Age	No of participants	Percentage
0-20	06	4.2%
20-40	27	19.2%
40-60	55	39.2%
60-80	48	34.2%
80-100	04	2.8%
100 and more	00	0%

TOTAL	140	100%

Fig.3: Age-wise Distribution of patients in ICU. (n=140)

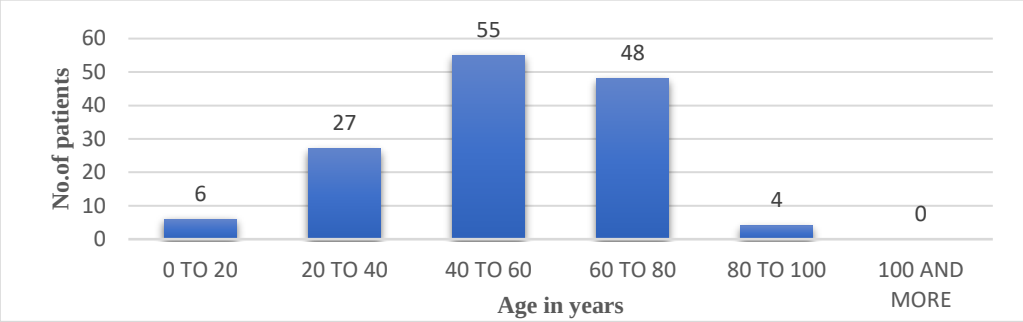


Table 3: Sex-wise Distribution of patients in ICU. (n=140)

Sex	No of patients	Percentage (%)
MALE	95	68%
FEMALE	45	32%
TOTAL	140	100%

Fig.4: Sex-wise Distribution of patients in ICU. (n=140)

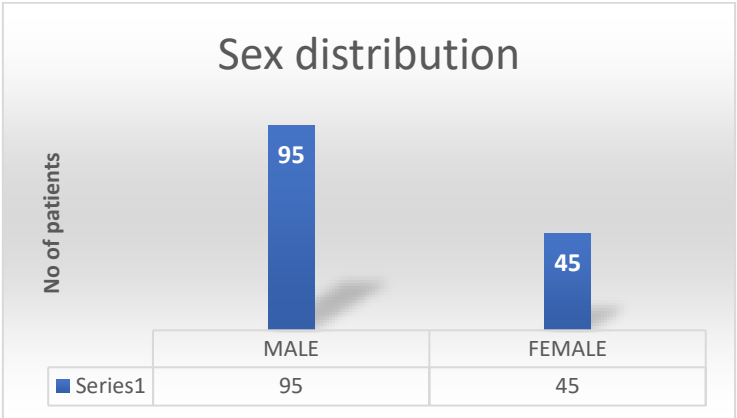


Table 5: Distribution of *Candida* isolates from skin lesions and without skin lesion(n=81)

Type	No. of samples	Percentage (%)
SKIN LESIONS	43	53%
WITHOUT SKIN LESION	38	47%
TOTAL	81	100%

Fig.6: Distribution of *Candida* isolates from skin lesions and without skin lesion(n=81)

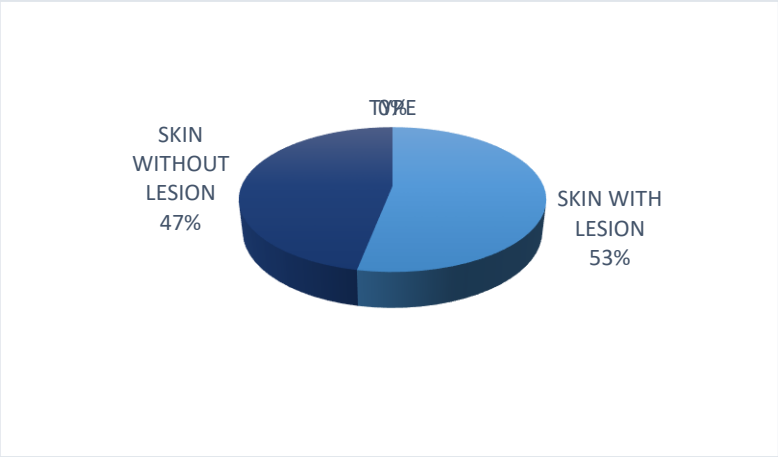


Table 6: *Candida species* isolates from patients with skin lesion(n=43)

Species	NO of isolates	Percentages (%)
Candida albicans	12	28%
Candida tropicalis	19	44%
Candida glabrata	06	14%
Candida krusei	03	7%
Candida paraplopsis	03	7%
TOTAL	43	100%

Fig.7: *Candida species* isolates from patients with skin lesion(n=43)

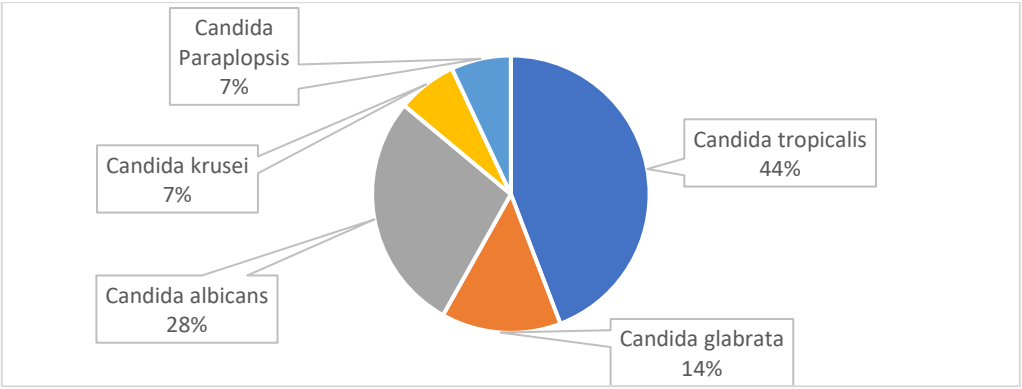
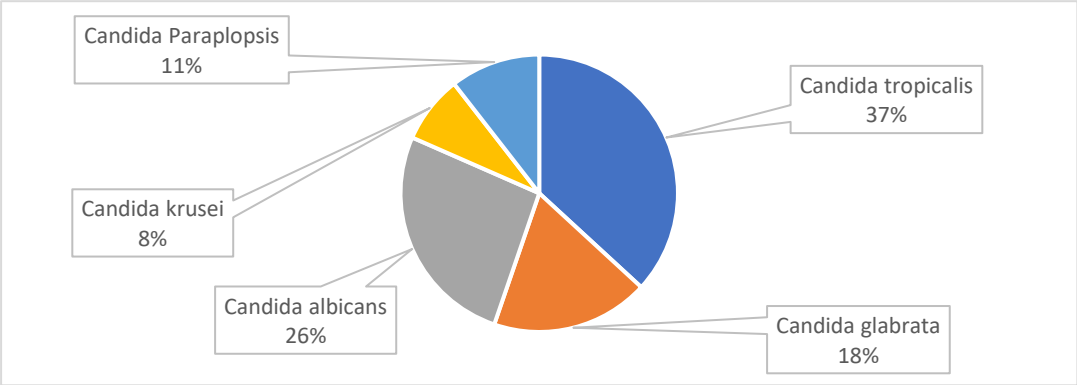


Table 7: *Candida species* isolates from patients without skin lesion(n=38)

Species	No. of isolates	Percentages (%)
Candida albicans	10	26%
Candida tropicalis	14	37%

Candida glabrata	07	18%
Candida krusei	03	8%
Candida paraplopsis	04	11%
TOTAL	38	100%

Fig.8: *Candida species* isolates from patients without skin lesion (n=38



Sr. no	Variables	No. of positive outcome	Odd's ratio	P value
1	Age (>50 years)	38	1.2	0.7
2	Gender (male)	38	0.5	0.1
3	Diabetes	39	1.3	0.5
4	Ventilator	51	6.3	<0.0001
5	Duration of stay (>10 days	60	18.0	<0.0001

Table 8: Analysis of risk factors of candidiasis in ICU

Discussion

From December 2022 to February 2024, a comprehensive study was conducted involving 140 ICU patients to assess *Candida* infection and colonization. Of these patients, 70% were from the Medical Intensive Care Unit (MICU), while 30% were from the Surgical Intensive Care Unit (SICU). The demographic breakdown revealed that the majority of patients (39.2%) were aged between 40-60 years, followed closely by those in the 60-80 age group (32.2%). Males comprised 68% of the patient population, while females accounted for 32%.

Out of the samples tested for *Candida*, 71% showed no growth, while 29% exhibited positive growth, indicating the presence of *Candida species*. Among the 81 *Candida* growths detected, 53% originated from swabs taken from lesions, whereas 47% were identified in samples taken from areas without lesions. This distribution underscores the relevance of screening both lesion and non-lesion sites for a more accurate assessment of *Candida* colonization.

Comparing the results to previous studies, Singh et al. [7] found a higher fungal infection rate (82.7%) compared to colonization (17.3%) in North India, which suggests regional variations in the prevalence of *Candida* infections. In this study, among the 43 *Candida* isolates obtained from skin lesion swabs, *Candida albicans* constituted 28% of the isolates, *Candida tropicalis* made up 44%, *Candida glabrata* 14%, *Candida krusei* 7%, and *Candida parapsilosis* 7%. In contrast, Nigar et al[8] reported different proportions in their study: *C. albicans* (51.53%), *C. tropicalis* (26.56%), *C. glabrata* (6.25%), *C. parapsilosis* (6.25%), and *C. krusei* (4.68%).

In patients without visible skin lesions, the *Candida* isolates exhibited a slightly different distribution. The proportions were as follows: *C. albicans* (26%), *C. tropicalis* (37%), *C. glabrata* (18%), *C. krusei* (8%), and *C. parapsilosis* (11%). A study by Caggiano et al[9] reported contrasting findings, with their proportions showing *C. albicans* (76.2%), *C. glabrata* (23.8%), *C. krusei* (19%), *C. parapsilosis* (9.5%), and both *C. tropicalis* and *C. kefyr* at (4.7%).

The study also highlighted certain factors that were significantly associated with positive *Candida* outcomes, particularly the presence of mechanical ventilation and an ICU stay exceeding 10 days. These were strong predictors of *Candida* colonization and infection. However, other factors such as age over 50, diabetes, and gender did not show significant correlation with positive *Candida* outcomes. Similarly, Adiguzel et al[10]identified risk factors that align with the present study, including invasive mechanical ventilation, the use of central venous catheters, infections, total parenteral nutrition, the use of multiple antibiotics, ventilator-associated tracheobronchitis, and sepsis as contributors to the development of *Candida* infections in ICU patients.

These findings underscore the importance of identifying and mitigating these risk factors, particularly in ICU settings, where patients are highly susceptible to invasive fungal infections like candidiasis.

Conclusion

This study, conducted among 140 ICU patients to evaluate *Candida* infection and colonization, provided valuable insights into the epidemiology of *Candida* species in a critical care setting. The majority of the patients were from the Medical Intensive Care Unit (MICU), with most falling within the 40-60 age group, and a marked male predominance (68% male, 32% female). Of the samples collected and tested, 71% showed no fungal growth, while 29% tested positive for *Candida species*. Importantly, of those samples that exhibited *Candida* growth, 53% were from skin swabs taken from areas with lesions, and 47% were from areas without visible lesions.

The study also revealed notable regional variations in *Candida* prevalence and species distribution when compared to similar studies. It was observed that patients with skin lesions had a distinct distribution of *Candida species*, with *Candida albicans*, *Candida tropicalis*, *Candida glabrata*, *Candida krusei*, and *Candida parapsilosis* being the most frequently isolated species. Patients without lesions showed a

slightly different pattern, with a higher proportion of *C. tropicalis* and other non-*albicans* species, highlighting the complex nature of *Candida* colonization in different clinical contexts.

Further analysis identified several risk factors associated with *Candida* infections in ICU patients. The presence of mechanical ventilators and extended ICU stays (longer than 10 days) were found to be significant predictors of *Candida* colonization and infection. These findings are consistent with other studies, which have shown that critical care interventions, such as the use of invasive devices and prolonged hospitalization, significantly increase the risk of fungal infections in ICU patients. However, factors such as age over 50, diabetes, and gender did not emerge as significant predictors in this particular study, suggesting that the clinical management of Candida infections may require a more nuanced approach.

The study emphasizes the need for tailored management strategies to prevent and control *Candida* infections in ICU settings. Given the rising prevalence of non-*albicansCandida species*, which are often resistant to standard antifungal treatments, it is essential for healthcare providers to adopt targeted infection control measures and employ early diagnostic methods. These approaches can help mitigate the risk of fungal infections, improve patient outcomes, and reduce the overall burden of candidiasis in critical care environments.

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