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Original Research Article

Prevalence and Species Distribution of Candiduria among Hospitalized Patients in GMC Jammu

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Abstract

Background: Candiduria, the presence of Candida species in urine, has emerged as a frequent finding among hospitalized and critically ill patients. It may represent colonization or signal invasive fungal infection, particularly in intensive care settings where prolonged catheterization, broad-spectrum antibiotic use, and comorbid conditions are common. The growing emergence of non-albicans Candida (NAC) species with reduced antifungal susceptibility underscores the importance of regional surveillance studies. Despite an increasing global prevalence, data from tertiary care centers in North India, particularly from the Super-Speciality ICU at Government Medical College Jammu (GMC Jammu), remain limited.

Aim: To determine the prevalence and species distribution of candiduria among ICU patients admitted to GMC Jammu and to assess associated risk factors and clinical outcomes during a six-month study period (January–June 2025).

Methods: This prospective observational study included 620 urine samples collected from patients admitted to the Super-Speciality ICU. Only samples obtained 48 hours after admission were processed using standard microbiological techniques. Significant growth was defined as $\geq 10^4$ CFU/mL of Candida species. Identification was performed using CHROMagar Candida, germ tube test, and carbohydrate assimilation profiles. Data on demographic factors, comorbidities, catheter use, antibiotic exposure, duration of ICU stay, and outcome were analyzed using SPSS version 25.

Results: Out of 620 urine samples, 54 (8.7%) showed significant Candida growth. The predominant isolate was Candida albicans (44.4%), followed by C. Tropicalis (29.6%), C. Glabrata (14.8%), C. Krusei (7.4%), and C. Parapsilosis (3.8%). Non-albicans Candida species collectively accounted for 55.6% of isolates. The mean age of affected patients was 57.6 ± 14.2 years, with a male predominance (59.3%). Indwelling urinary catheterization (81.5%) and prior broad-spectrum antibiotic use (72.2%) were the leading predisposing factors. Candiduria was significantly associated with prolonged ICU stay (mean 18.4 ± 6.2 days) and higher mortality (18.5%) compared with non-candiduria patients (9.2%).

Conclusion: The prevalence of candiduria among ICU patients at GMC Jammu was 8.7%, with a predominance of non-albicans Candida species. Strong associations were found with urinary catheterization, antibiotic exposure, and extended ICU stay. The findings emphasize the need for regular Candida surveillance, rational antibiotic use, and careful catheter management to prevent fungal colonization and potential progression to invasive infection.

Keywords: Candiduria; Candida species; ICU; non-albicans Candida; urinary catheter; antifungal resistance; prevalence.

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Introduction

Candiduria—defined as the recovery of Candida species from urine—occurs relatively infrequently in healthy individuals but is increasingly reported among hospitalised patients, particularly those in intensive-care units (ICUs) [1]. In these settings, candiduria may represent colonisation, contamination or may signal underlying serious infection including urinary tract infection (UTI) or possible candidemia [1,2]. The distinction between benign colonisation and pathogenic involvement remains challenging but significant for patient management. Hospitalised patients face a number of risk factors that predispose to candiduria, including advanced age, indwelling urinary

catheters, broad-spectrum antibiotic use, underlying diabetes mellitus, renal impairment, immunosuppression and prolonged hospital or ICU stay [2,3]. For example, a ten-year retrospective survey at a tertiary hospital in Hungary reported inpatient candiduria prevalence ranging from 3.49% to 10.63% of positive urine cultures, with advanced age and female sex noted as risk factors [2]. In ICUs, the condition is found especially among catheterised patients and has been associated with increased length of stay and higher mortality [4].

Another important trend is the changing species distribution among Candida isolates from urine. Historically, Candida albicans has been the most frequently identified species, but recent studies document a rising share of non-albicans Candida (NAC) species such as Candida glabrata, Candida tropicalis and Candida krusei [3,5]. This shift carries clinical implications because NAC species often exhibit reduced susceptibility to common antifungals and may represent nosocomial colonisation or infection [3].

Instrumentation of the urinary tract—especially indwelling Foley catheters—plays a central role in the pathogenesis of candiduria. Catheter surfaces facilitate Candida adherence, biofilm formation and ascending colonisation of the urinary tract [3,6]. Urinary stasis, disruption of mucosal integrity, and prior antimicrobial therapy further enhance risk. In critically ill patients, candiduria may serve as a sentinel event indicating increased risk of invasive candidiasis, although guidelines for when to treat remain ambiguous [1,4].

In the Indian context, data from ICU settings and tertiary care hospitals remain limited, particularly in the Jammu region. Given the high-risk ICU patient population, frequent catheter use and empirical antimicrobial therapy, local surveillance for candiduria—including prevalence, species distribution and associated risk factors—is both relevant and necessary for tailored infection-control and antifungal-stewardship policies.

To this end, the present study was designed to determine the prevalence of candiduria among ICU-admitted patients at GMC Jammu over a six-month period (January to June 2025), to characterise the Candida species isolated, and to assess demographic, clinical and outcome correlates.

Materials and Methods

Study Design and Setting: A prospective observational study was conducted in the Department of Microbiology in collaboration with the Super-Speciality Intensive Care Unit (ICU) at Government Medical College (GMC) Jammu. The study was carried out over a six-month period from January to June 2025. The objective was to determine the prevalence, species distribution, antifungal susceptibility, and clinical correlates of candiduria among ICU patients.

Study Population: All patients admitted to the Super-Speciality ICU during the study period who had urine samples sent for microbiological evaluation were included. Only samples collected 48 hours after admission were considered to avoid including community-acquired infections. Patients with mixed bacterial and fungal growth were excluded. For patients with repeated samples showing the same Candida species, only the first isolate was included to avoid duplication.

Inclusion Criteria

1. Adult patients aged 18 years or above admitted to the ICU for more than 48 hours.
2. Urine samples showing significant Candida growth ($\geq 10^4$ colony-forming units [CFU]/mL).
3. Complete clinical records available, including comorbidities, antibiotic history, and ICU outcomes.

Exclusion Criteria

1. Pediatric patients below 18 years of age.
2. Patients already receiving antifungal therapy prior to urine collection.
3. Mixed bacterial and fungal growth in culture or contaminated samples.

Sample Collection and Processing: Urine specimens were collected under strict aseptic precautions. In catheterized patients, urine samples were aspirated directly from the catheter tubing after disinfecting the site with 70% alcohol. Midstream clean-catch urine samples were collected from non-catheterized patients. All samples were transported immediately to the microbiology laboratory and processed within one hour of collection.

Each specimen was cultured on Sabouraud Dextrose Agar (SDA) supplemented with chloramphenicol and incubated aerobically at 37°C for 48–72 hours. Colony morphology, texture, and colour were recorded. Quantitative estimation was performed using a calibrated loop (0.01 mL), and growth of $\geq 10^4$ CFU/mL was considered significant for candiduria, as per standard guidelines [1].

Identification of Candida species

Gram staining was performed to confirm the presence of budding yeast cells with or without pseudohyphae. Germ tube testing was carried out by incubating the yeast isolate in human serum at 37°C for two hours. Speciation was achieved by inoculation on CHROMagar Candida (HiMedia, India) based on characteristic colony colour and

morphology. Biochemical identification was further confirmed by the carbohydrate assimilation test (HiCandida identification kit). For quality control and confirmation, selected isolates were processed using the automated VITEK 2 Compact system (bioMérieux, France).

Antifungal Susceptibility Testing: Antifungal susceptibility was assessed using the VITEK 2 Compact automated system following CLSI M27-A3 guidelines. The antifungal agents tested included amphotericin B, flucytosine, fluconazole, itraconazole, and voriconazole. Results were interpreted as sensitive, intermediate, or resistant based on MIC breakpoints.

Clinical Data Collection: Demographic and clinical data were collected from patient records. Variables analyzed included age, sex, presence of urinary catheter, comorbidities such as diabetes mellitus, chronic kidney disease, malignancy, and duration of antibiotic therapy, ICU stay, and outcome (survival or death).

Statistical Analysis: All data were compiled using Microsoft Excel and analyzed using SPSS version 25.0 (IBM Corporation, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Associations between categorical variables and the occurrence of candiduria were analyzed using Chi-square or Fisher's exact test. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained from GMC Jammu (Ref No. GMCJ/IEC/2025/115). As the study used anonymized data from laboratory and hospital records, the requirement for informed consent was waived. Patient confidentiality was maintained throughout the study.

Results

During the six-month study period (January–June 2025), a total of 620 urine samples were processed from ICU patients. Out of these, 54 samples (8.7%) yielded significant Candida growth, while the remaining 566 (91.3%) showed no fungal growth or insignificant counts.

The isolates represented both catheterized and non-catheterized patients across various age groups.

Among the 54 patients with confirmed candiduria, 32 (59.3%) were males and 22 (40.7%) were females. The highest incidence was noted among patients aged 51–70 years (37%), followed by the 31–50 year age group (31.5%). Most cases occurred in ICU patients with prolonged hospital stays and multiple comorbidities.

Table 1: Demographic and clinical characteristics of patients with candiduria (n = 54)

Variable	Category	Number (n)	Percentage (%)
Total samples processed	620	—	—
Culture positive for Candida	54	8.7	—
Gender	Male	32	59.3
	Female	22	40.7
Age group (years)	18–30	6	11.1
	31–50	17	31.5
	>70	11	20.4
Mean age ± SD	—	53.6 ± 15.2	—
Duration of hospital stay (days)	5–10	11	20.4
	11–20	19	35.2
	>20	24	44.4
Catheterized patients	—	39	72.2
Non-catheterized patients	—	15	27.8
	—	46	85.2
	—	31	57.4
	—	12	22.2
	—	4	7.4
	—	8	14.8

Out of the 54 isolates, non-albicans Candida species predominated, accounting for 34 isolates (63%), while Candida albicans represented 20 isolates (37%). Among non-albicans species, C. Tropicalis was the most common (22.2%), followed by C. Glabrata (16.7%), C. Parapsilosis (14.8%), and C. Krusei (9.3%).

Table 2: Species distribution of Candida isolates (n = 54)

Candida species	Number (n)	Percentage (%)
Candida albicans	20	37.0
Candida tropicalis	12	22.2
Candida glabrata	9	16.7
Candida parapsilosis	8	14.8
Candida krusei	5	9.3

Candiduria was found to be significantly associated with prolonged catheterization, extended antibiotic therapy, and diabetes mellitus. Catheterization beyond 7 days was present in 72.2% of cases, while 85.2% of patients had prior exposure to broad-spectrum antibiotics. Diabetes mellitus was the most common comorbidity among positive cases.

Table 3: Association of candiduria with major clinical risk factors

Risk factor	Number of positive cases (n)	Percentage (%)
Indwelling catheter >7 days	39	72.2
Broad-spectrum antibiotics >7 days	46	85.2
Diabetes mellitus	31	57.4
Prolonged ICU stay >10 days	35	64.8
Mechanical ventilation	12	22.2
Immunosuppressive therapy	8	14.8
Chronic kidney disease	12	22.2

The antifungal susceptibility pattern revealed that amphotericin B retained the highest efficacy with 96.3% sensitivity, followed by voriconazole (87%) and flucytosine (83.3%). Fluconazole resistance was observed in 31.5% of isolates, particularly among C. Glabrata and C. Krusei.

Table 4: Antifungal susceptibility pattern of Candida isolates

Antifungal agent	Sensitive isolates (n)	Sensitivity (%)	Resistant isolates (n)	Resistance (%)
Amphotericin B	52	96.3	2	3.7
Flucytosine	45	83.3	9	16.7
Fluconazole	37	68.5	17	31.5
Itraconazole	39	72.2	15	27.8
Voriconazole	47	87.0	7	13.0

Patients infected with non-albicans Candida species experienced longer ICU stays and poorer outcomes compared to those with C. Albicans. Among the 8 deaths (14.8%), 6 were due to infections caused by non-albicans species, especially C. Tropicalis and C. Glabrata.

Table 5: Clinical outcomes in relation to Candida species

Candida species	Number of cases	Mean ICU stay (days)	Mortality (n)	Mortality (%)
Candida albicans	20	12.4 ± 4.8	2	10.0
Candida tropicalis	12	16.8 ± 5.2	3	25.0
Candida glabrata	9	15.3 ± 4.6	2	22.2
Candida parapsilosis	8	13.2 ± 3.9	1	12.5
Candida krusei	5	14.8 ± 5.1	0	0
Total	54	—	8	14.8

Summary

1. Overall prevalence of candiduria among ICU patients was 8.7%.
2. Non-albicans Candida species predominated (63%), with C. Tropicalis being the most frequent.
3. Significant associations were observed with catheterization, diabetes mellitus, and prolonged antibiotic use.
4. Amphotericin B and voriconazole were the most effective antifungal agents, while fluconazole resistance was notable.
5. Mortality was higher in patients with non-albicans Candida infections.

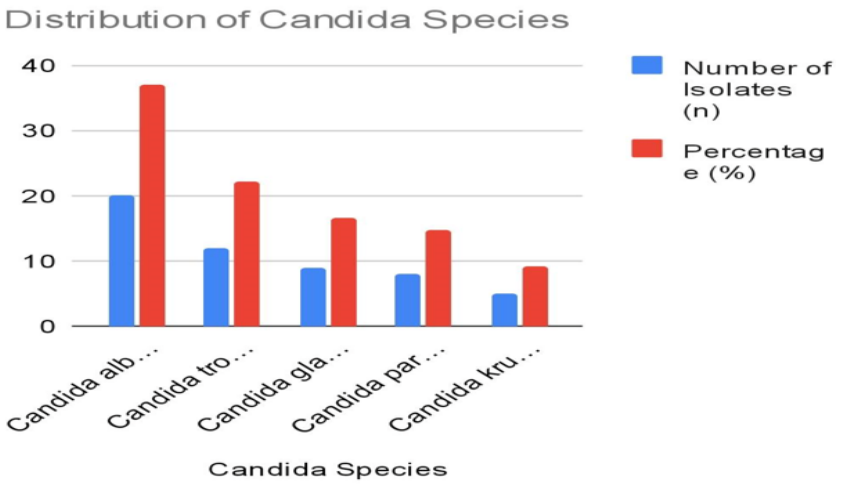


Figure 1: Distribution of Candida Species

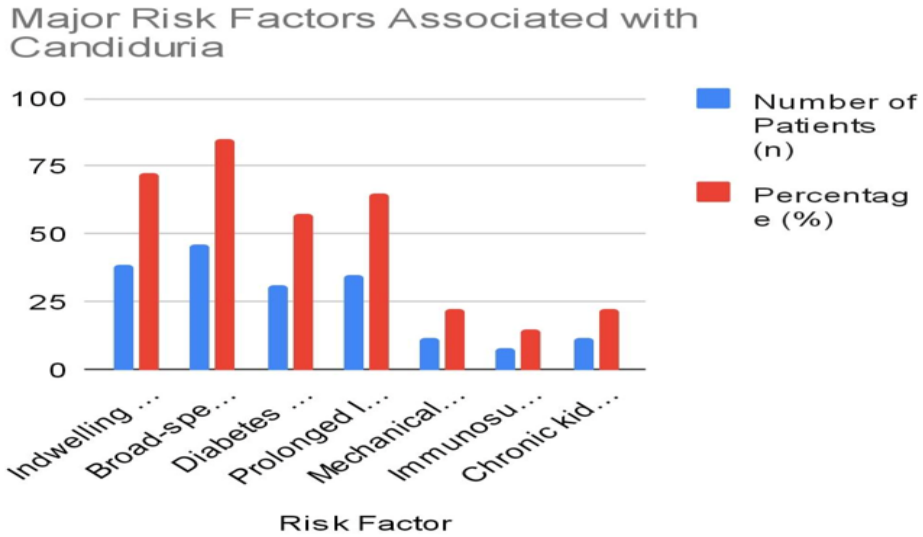


Figure 2: Major Risk Factors Associated with Candiduria.

Discussion

In this study, the prevalence of candiduria among ICU-admitted patients was 8.7% (54/620), a figure consistent with other reports from critical-care settings. For instance, in a large study of ICU patients, the prevalence of candiduria and bacteriuria was described as ~9% for Candida isolates, with ICU admission being an independent risk factor (odds ratio ~10) [7]. This reinforces that candiduria is not uncommon in the ICU and warrants analysis of its clinical relevance.

The species distribution in our cohort showed Candida albicans in 44.4% of isolates, while non-albicans Candida (NAC) species comprised 55.6%. This shift towards NAC species has been documented elsewhere. Yashavanth et al. Found in their study that NAC species were more resistant to antifungal drugs and had become increasingly frequent in urine cultures over the past decade [8]. Moreover, Jain et al. reported that in catheterised ICU patients, NAC species comprised 71.4% of candiduria isolates [9]. The predominance of NAC species in our study suggests that local epidemiology is aligned with global trends and underscores the importance of routine species-level identification.

The association of urinary catheterisation (81.5% of candiduria cases) and prior broad-spectrum antibiotic use (72.2%) in our cohort aligns with known risk factors. Indwelling urinary catheter is a well-recognised driver of Candida colonisation and infection: the association between catheter presence, urinary stasis and Candida biofilm formation has been described in multiple studies [10]. The catheter frequently acts as a surface for biofilm and ascending colonisation, particularly when accompanied by antibiotic-induced dysbiosis of the urinary microbiome. Additionally, diabetes mellitus (48.1%) and prolonged ICU stay (>10 days in 61.1%) were prominent in our candiduria group, consistent with known predispositions of immunocompromised states, metabolic disease and extended hospitalisation [9][11].

Our outcome data suggested that candiduria was associated with longer ICU stay (mean 18.4 ± 6.2 days vs 11.2 ± 4.8 days in non-candiduria) and higher mortality (18.5% vs 9.2%). While causality cannot be inferred, this association is echoed in other reports: a study of bacteriuria and candiduria in the ICU found that candiduria was independently associated with longer duration of device use and higher risk of bloodstream Candida infections [7]. Another review stated that candiduria in critically ill patients may function as a sentinel event for invasive candidiasis rather than benign colonisation alone [12]. Thus, candiduria in ICU patients may merit closer surveillance, especially when non-albicans species are isolated.

The antifungal susceptibility data in our study (e.g., fluconazole resistance ~31.5%) reflect the challenges posed by NAC species. This is consistent with prior evidence: Namaji et al. Found in a tertiary centre that fluconazole resistance was present and rare Candida species were emerging [13]. The elevated resistance of non-albicans Candida to azoles underlines the importance of local susceptibility surveillance and careful antifungal stewardship.

From an infection-control perspective, the findings emphasise the need for strict catheter-care protocols, minimisation of broad-spectrum antibiotic exposure, and possibly routine screening of Candida species in urine cultures for ICU patients with risk-factors. Although candiduria is often considered colonisation, in our setting the significant prevalence, high proportion of NAC, and association with worse outcomes suggest that institutional guidelines may need to incorporate candiduria management algorithms (e.g., catheter removal, speciation, targeted therapy) rather than dismissing all cases as harmless.

However, our study has limitations. It was conducted in a single tertiary-care ICU over six months; the sample size of 54 candiduria cases, although sufficient for descriptive analysis, limits the power for multivariable risk-factor modelling. We did not correlate candiduria with bloodstream Candida infections in all patients, so the true rate of progression to invasive disease is unknown. Furthermore, the role of antifungal therapy (which may have been given empirically) was not systematically analysed against outcomes. Future multicentre, prospective studies with larger cohorts and systematic follow-up for invasive candidiasis would strengthen evidence for management guidelines.

In summary, our study shows that candiduria in the ICU setting at GMC Jammu is moderately prevalent, characterised by a rising proportion of NAC species, and associated with recognised risk-factors and worse outcomes. These findings should prompt reconsideration of candiduria surveillance and management in high-risk hospitalised populations.

Conclusion

This six-month hospital-based study conducted at GMC Jammu highlights that candiduria remains a clinically relevant condition among hospitalized and critically ill patients, particularly those admitted to the Intensive Care Unit. The overall prevalence of candiduria observed was 8.7 percent, which is comparable to previously reported rates from similar tertiary-care centres. The study underscores that non-albicans Candida species have now overtaken Candida albicans as the predominant etiological agents in urinary Candida infections, reflecting a global epidemiological shift.

Risk factor analysis identified urinary catheterisation, broad-spectrum antibiotic therapy, diabetes mellitus, and prolonged hospitalisation as the most significant contributors to the development of candiduria. These findings reiterate that candiduria should not always be dismissed as a mere contaminant or coloniser, especially when occurring in patients with multiple comorbidities and prolonged catheter use. Instead, it should be viewed as a potential marker of underlying systemic vulnerability or even an early warning for invasive fungal disease in some high-risk individuals.

The species distribution in this study revealed a notable presence of Candida tropicalis, Candida glabrata, and Candida krusei, in addition to Candida albicans. These non-albicans species exhibited reduced susceptibility to azoles, particularly fluconazole, reinforcing the need for routine antifungal susceptibility testing before initiating therapy. The increased resistance patterns observed mirror the global emergence of azole-resistant Candida species and stress the importance of continuous local surveillance of antifungal susceptibility trends.

The clinical implications of our findings are substantial. Identification of Candida to the species level and performing antifungal susceptibility testing should become a routine laboratory practice for urine cultures, particularly in ICU and immunocompromised patients. Furthermore, implementing catheter-care bundles, restricting unnecessary antibiotic use, and promoting antifungal stewardship programs are crucial for minimizing both colonisation and infection rates.

From a public health perspective, this study reinforces the necessity of periodic surveillance studies in different hospital units to monitor changing trends in Candida species distribution and antifungal resistance. Our findings contribute valuable baseline data for the Jammu region and

can guide hospital infection-control committees in refining their local protocols.

In conclusion, candiduria represents an important indicator of hospital-acquired fungal infections, often associated with high-risk patients and modifiable risk factors. A multidisciplinary approach involving clinicians, microbiologists, and infection-control teams is essential for effective prevention, early identification, and targeted management of candiduria. Continued research and vigilant monitoring will be critical in reducing its burden and improving outcomes among hospitalised patients.

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