

Prevalence of *Candida* Species Isolates in Patients with Urinary Tract Infection in Madinah, Saudi Arabia

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Received: July 8, 2023 Accepted: August 4, 2023 Online Published: August 8, 2023

doi:10.5539/gjhs.v15n9p27

URL: <https://doi.org/10.5539/gjhs.v15n9p27>

Abstract

Introduction: Urinary tract infections (UTIs) is considered one of the most prevalent infections that may lead to many renal complications or dysfunctions. They are responsible for almost 10% of all infections in Saudi Arabia, which makes them the second most common cause of emergency department admission. Bacteria are the most common pathogens associated with UTIs. Nevertheless, UTIs caused by fungi have also been reported. Among fungal infections, *Candida* spp. has been identified as the primary cause of UTI-related mycoses.

Objective: To assess the prevalence of *Candida* species isolated from adult patients in Madinah, Saudi Arabia.

Materials and Methods: A retrospective cross-sectional study was performed using data collected from patients who visited King Fahad General Hospital in Madinah, Saudi Arabia. A total of 16803 urine bacterial cultures data were collected from January 2019 to October 2021.

Results: Among the 4281 positive urine cultures, 92% (n = 3937) showed bacterial growth, while 8% (n = 344) exhibited fungal growth. Female patients had a slightly higher percentage of fungal-positive cases (53%, n = 181) compared to males (47%, n = 163). Among different nationalities, Saudi citizens had the highest prevalence of positive fungal samples (64%, n = 220). Most positive cases (49%, n = 167) were isolated in 2019, with a decline in subsequent years. Non-*Candida albicans* spp. (86.3%, n = 297) were the most common fungal species, followed by *Candida albicans* (13.7%, n = 47).

Conclusion: Despite considering bacterial UTIs to be more prevalent than UTI-related mycoses, it remains crucial to accurately identify the causative agent for proper diagnosis and treatment. UTI-related mycosis caused by non-*Candida albicans* spp. has significantly increased compared to *Candida albicans*. Thus, monitoring these trends over time can provide valuable insights for developing preventive strategies and optimizing treatment approaches.

Keywords: UTIs, Candiduria., Uropathogen, *C. albicans*, non-*Candida albicans*

1. Introduction

Urinary tract infections (UTIs) are a common medical condition that is most often caused by bacterial infections (Stamm & Norrby, 2001). However, it is important to note that UTIs can also be caused by fungi, particularly in individuals with compromised immune systems or who are under antibiotic treatment (Gajdacs et al., 2019). Fungal UTIs can be associated with symptoms such as frequent urination, painful urination, and cloudy or foul-smelling urine, in addition, they may also cause lower abdominal pain, fever, and chills (Behzadi et al., 2015). Funguria, which describes the presence of fungi in the urine, is typically uncommon in healthy individuals (Bukhary, 2008). However, there have been reported cases of Funguria in people with a stable immune system who were influenced by other risk factors, including the usage of indwelling urinary devices, advanced age, diabetes mellitus, female gender, prior antibiotic use, and prolonged hospitalization (Abishek et al., 2019; Gajdacs et al., 2019).

Candida spp. is an opportunistic fungus that commonly colonizes the mucous membranes of different body parts, including the urinary tract, vagina, and oral cavity (Lass-Flörl, 2009). While *Candida* spp. is typically harmless in small amounts, it can occasionally proliferate under favorable conditions to cause infections, including urinary tract infections (UTIs) (Abishek et al., 2019). Indeed *Candida* spp. is considered the most common fungi causing

UTIs (Rivett et al., 1986). Nowadays, the number of reported incidences of Candidal UTIs has dramatically increased causing serious public health concerns (Alfouzan & Dhar, 2017; Gajdacs et al., 2019).

The diagnosis of UTI-related mycoses is typically made by analyzing a urine sample and identifying the presence and count of fungal cells. While *Candida albicans* (*C. albicans*) is the most commonly isolated fungus from urine, accounting for 50-70% of cases, recent research indicates an increasing prevalence of UTIs caused by non-*Candida albicans* species (Behzadi et al., 2015; Fisher et al., 2011; Kauffman et al., 2011).

The aim of this study is to assess the prevalence of *Candida* species isolated from the urine of adult patients with suspected UTIs over a period of three years at King Fahad General Hospital in Madinah, Saudi Arabia.

2. Method

2.1 Sample Collection and Exclusion Criteria

A retrospective cross-sectional study was performed on 16803 urine sample data collected from patients in different hospital wards, including the intensive care unit (ICU), emergency department (ER), and outpatient clinics at King Fahad General Hospital, Madinah, Saudi Arabia between January 2019 and October 2021. All samples were tested for microbial growth using conventional and automated identification methods. The study included all patients aged 18 years or older with suspected UTIs. Data that did not meet the predefined inclusion criteria were excluded from the analysis.

2.2 Fungal Culture and Identification

Urine samples were cultured on different media according to the hospital's protocol. For fungal identification, samples were cultured on Sabouraud Dextrose Agar (SDA) and incubated at 37°C for 24/48 hrs. For any significant growth ($>10^3$ CFU/mL) a wet mount of an isolated colony was prepared and examined microscopically. *Candida* spp. were identified by germ tube formation and VITEK 2 system (bioMérieux, USA).

2.3 Statistical Analysis

Data were presented as percentages. All data were analyzed using GraphPad Prism v. 9.0 software (San Diego, USA).

2.4 Ethical Approval

This study was approved by the Ethics Committee of King Salman bin Abdulaziz Medical City (Institutional Review Board no. 22-014). The data used in this study were appropriately anonymized; therefore, no informed consent was required. All methods in this study were conducted in compliance with the relevant guidelines and regulations pertaining to studies involving human subjects.

3. Results

A total of 4281 urine samples were positive for microbial growth. Bacterial growth accounted for 92% (n= 3937), while 8% (n = 344) were positive for fungal growth (Figure 1, A). Moreover, the number of fungal-positive samples was slightly higher in female patients 53% (n = 181). compared to 47% (n = 163) of positive samples collected from male patients (Figure 1, B).

Regarding patients' nationality, most positive fungal samples 64% (n = 220) were isolated from Saudis representing the highest prevalence of positive cases, followed by Pakistanis and Afghanis (Table 1).

Furthermore, a significant percentage of the positive samples 49% (n = 167) were isolated between January and December 2019 with a gradual decline in subsequent years (Figure 1, C). As shown in Figure 1, D non-*Candida albicans* were the most isolated fungi (297; 86.3%), followed by *C. albicans* accounting for (47; 13.7%).

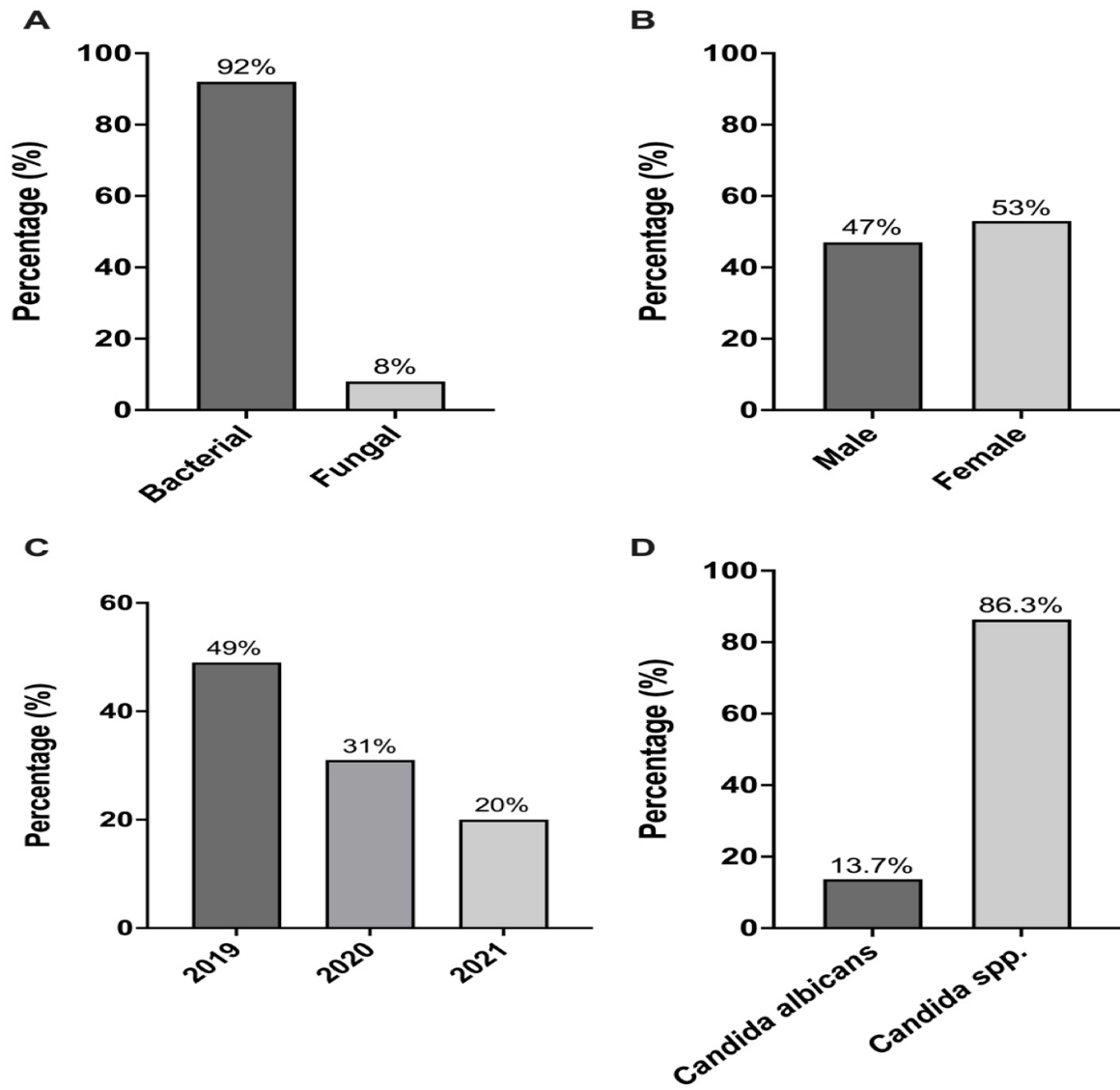


Figure 1. Percentages of UTI cases according to A; Etiological agents, B; Gender, C; Chronological distribution, D; Fungal species.

Table 1. Distribution of UTI-related mycoses by nationality and gender

Nationality	Male	Female	Total	%
Saudi	105	115	220	64
Pakistani	8	14	22	6.4
Afghan	8	6	14	4.1
Egyptian	5	7	12	3.5
Mauritanian	7	5	12	3.5
Yemeni	4	6	10	2.9
Indonesian	3	5	8	2.3
Syrian	6	2	8	2.3
Palestinian	5	2	7	2.0
Sudanese	2	5	7	2.0
Filipino	0	6	6	1.7
Nigerian	3	3	6	1.7
Algerian	3	0	3	0.9
Chadian	1	1	2	0.6
Moroccan	0	2	2	0.6
Ethiopian	0	1	1	0.3
Bangli	1	0	1	0.3
Bruneian	1	0	1	0.3
Indian	0	1	1	0.3
Malaysian	1	0	1	0.3
Total	163	181	344	100

4. Discussion

The aim of the study was to assess the prevalence of fungal growth in urine samples collected from various hospital wards at King Fahad General Hospital in Madinah, Saudi Arabia. A large sample size of 16,803 urine samples were collected between January 2019 and October 2021, from adult patients suspected of UTIs. Fungal growth represented 8% of the positive cases, among those 13.7% *C. albicans* while, 86.3% associated with non-*Candida albicans*.

Unsurprisingly, a slightly higher number of positive fungal samples were observed in female patients (47%) compared to male patients (58%) (Figure 1 D). This finding was consistent with other studies that showed a higher prevalence of Candiduria among females attributed to anatomical and hormonal factors, as well as the colonization of the external side of the urethral opening in healthy females (Abishek et al., 2019; Fisher et al., 2011; Mishra, Kumari, & Mishra, 2022).

When considering the nationality of patients, it was found that most positive fungal samples were isolated from Saudis followed by Pakistanis and Afghans (Table 1). This might be attributed to various factors such as lifestyle factors, or healthcare-seeking behaviors. Examining the chronological distribution of positive samples, a significant proportion was isolated between January and December 2019, with a gradual decline in subsequent years (Figure 1b). This finding might be potentially influenced by seasonal factors or the preventive measures implemented during subsequent years due to the COVID-19 pandemic.

Investigating the isolated fungal species, *C. albicans* were isolated from 13.7% of total fungal-positive samples. This finding is contradictory to most reported cases where *C. albicans* was the most prevalent isolated fungal spp. (Gajdacs et al., 2019; Kassid & Hamied, 2022). However, non-*Candida albicans* spp. was reported to be a new emerging dominant isolated group (Abishek et al., 2019; Jain et al., 2019; Kobayashi et al., 2004). Our results strongly support this finding where we demonstrated an increase in the numbers of the non-*Candida albicans* spp. isolated from UTI patients (86.3%). This may pose challenges in terms of treatment and management due to their

potential resistance to commonly used antifungal medications.

It is essential to acknowledge some limitations of our study. Firstly, the study design relied on a retrospective analysis of existing data, which may have led to limitations in data collection. Secondly, even though the data was collected from a referral hospital, data collected from a single center limits the generalizability of our findings to other healthcare settings or regions.

5. Conclusion

The findings of this study focused on the prevalence and distribution of fungal growth in urine samples. These results provide valuable information for healthcare professionals in understanding the epidemiology and etiology of urinary tract infections caused by *Candida* spp. The increasing trend toward the emergence of non-*Candida albicans* spp. as significant pathogens in UTIs necessitates more targeted approaches in diagnosis, treatment, and prevention.

Acknowledgments

We acknowledge the generous help provided by Dr. Abdullah Almutairi (Head of the Microbiology Department, King Fahad General Hospital, Madinah, Saudi Arabia) in facilitating the data collection.

Authors' Contribution

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of results, and manuscript writing.

Competing Interests Statement

The authors declare no competing interests related to this study.

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