








Candida-Associated Urinary Tract Infections in Children: A Single-Center Experience

Çocuklarda Candida ilişkili Üriner Sistem Enfeksiyonları: Tek Merkez Deneyimi

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ÖZET

Giriş: Kronik hastalık, invaziv işlem, yoğun bakım ünitesinde yatış ve geniş spektrumlu antibiyotik kullanımı gibi durumlar kandidüri görülme sıklığını arttırmaktadır. Çalışmamızda kandidüri ile izlenen pediatrik hastaların klinik, laboratuvar özellikleri ve olası risk faktörlerinin değerlendirilmesini amaçladık. **Materyal-Metod:** Ocak 2017-Haziran 2024 tarihleri arasında kliniğimizde kandidüri saptanan 1 ay-18 yaş arası çocuk hastalar çalışmamıza dahil edildi.

Bulgular: Çalışmaya idrar kültüründe Candida spp. tespit edilen 58 (22 kız, 36 erkek) pediatrik hasta dahil edildi. Hastaların yaş ortalaması 6,2±2,9 idi. C. albicans 43 (%74,1) hastada, C. parapsilosis 8 (%13,7) hastada, C. tropicalis 4 (%6,8) hastada, C. lusitaniae 1 (1,7) hastada, C. lipolytica 1 (%1,7) hastada, C. krusei 1 (%1,7) hastada saptandı. İdrar kültüründe Candida spp. üremesi olan hastaların risk faktörleri değerlendirildiğinde en sık görülenler; üriner kataterizasyonu (%63,7), yoğun bakıma yatış (%60,3), uzun süreli antibiyotik kullanımı (58,6) ve santral venöz katater varlığı (%56,8) idi. Antifungal tedavi olarak 57 hastada flukonazol ve 1 hastada kaspofungin verildi. Kandidüri tanısı konulan tüm hastaların üriner kateterleri çıkarıldı. İdrar kültürü sterilizasyonuna kadar geçen medyan süre 4 gün ve antifungal tedavinin medyan süresi 7 gündü.

Sonuç: İnvaziv kandida enfeksiyonlarında lokal epidemiyolojik verilerin ve risk faktörlerinin bilinmesi ampirik tedavi için oldukça önemlidir. Risk faktörlerini barındıran hastalarda kandidüri akılda tutulmalıdır.

Anahtar Kelimeler: Kandidüri, Candida, çocuk, risk faktörü

ABSTRACT

Introduction: These infections are especially prevalent in nosocomial settings, affecting patients with predisposing conditions such as chronic illness, recent invasive procedures, admission to intensive care units (ICUs), and exposure to broad-spectrum antibiotics. This study aims to characterize the clinical presentation, laboratory findings, and risk factors associated with candiduria in a pediatric population.

Materials and Methods: This retrospective study analyzed data from pediatric patients aged 1 month to 18 years diagnosed with candiduria at our institution between January 2017 and June 2024.

Results: The study cohort comprised 58 pediatric patients (22 females, 36 males) with confirmed Candida species isolated from urine cultures. The mean age was 6.2 ± 2.9 years. Candida albicans was the most prevalent species, identified in 43 (74.1%) patients, followed by C. parapsilosis (13.7%), C. tropicalis (6.8%), C. lusitaniae (1.7%), C. lipolytica (1.7%), and C. krusei (1.7%). The most frequently observed risk factors among these patients were urinary catheterization (63.7%), ICU admission (60.3%), prolonged antibiotic use (58.6%), and the presence of a central venous catheter (56.8%). Antifungal therapy consisted of fluconazole in 57 patients and caspofungin in 1 patient.

Conclusion: Effective management of candiduria requires a thorough understanding of local epidemiological trends and patient-specific risk factors. In pediatric patients, candiduria, particularly when accompanied by multiple risk factors, necessitates careful clinical evaluation and tailored treatment strategies.

Key words: Candiduria, Candida, children, risk factors

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INTRODUCTION

Urinary tract infections (UTIs) are among the most prevalent nosocomial infections. While predominantly caused by bacteria, fungal pathogens, particularly *Candida* species, are increasingly recognized as significant causative agents in hospitalized patients (1). *Candida albicans* is the most frequently isolated species in candiduria, followed by *C. glabrata*, *C. parapsilosis*, and *C. tropicalis*. Several factors predispose patients to nosocomial candiduria, including urinary catheterization, broad-spectrum antibiotic use, and prolonged hospitalization (2).

Reducing the incidence of candiduria involves minimizing the use and duration of urinary catheterization, adhering to strict aseptic techniques during catheter insertion and maintenance, implementing rational antibiotic stewardship programs, and shortening the duration of intensive care units (ICU) and hospital stays (2, 3).

Asymptomatic candiduria often does not require antifungal therapy (4). However, in symptomatic cases, fluconazole is typically the first-line agent due to its favorable renal excretion and high urinary concentrations. Other azole antifungals, such as voriconazole, itraconazole, and posaconazole, are less effective due to their limited urinary penetration (1). This study aims to delineate the clinical and laboratory characteristics and identify potential risk factors associated with candiduria in pediatric patients.

MATERIAL AND METHODS

The study sample includes children aged 1 month to 18 years diagnosed with candiduria and followed at our clinic between January 2017 and June 2024. Patient data were extracted and analyzed from electronic medical records. Candiduria was defined as the isolation of *Candida* species from a urine specimen. While candiduria was observed in 90 pediatric patients, 32 patients identified as having catheter colonization were excluded based on this definition.

Descriptive statistics were employed to summarize the data, including frequency (n), percentage (%), arithmetic mean, standard deviation, and median (minimum-maximum).

RESULTS

The study cohort consisted of 58 pediatric patients (22 females, 36 males) with *Candida* species identified in their urine cultures. The mean age was 6.2 ± 2.9 years. Urine specimens were obtained via catheterization in 43 patients and by midstream collection in 15 patients. The distribution of *Candida* species was as follows: *C. albicans* in 43 (74.1%) patients, *C. parapsilosis* in 8 (13.7%), *C. tropicalis* in 4 (6.8%), *C. lusitanae* in 1 (1.7%), *C. lipolytica* in 1 (1.7%), and *C. krusei* in 1 (1.7%). Urinalysis revealed pyuria in 41 (70.6%) patients and hematuria in 40 (68.9%).

Table 1. Evaluation of risk factors in patients with *Candida* growth in urine culture

Risk factors	n (%)
Being in intensive care	35 (60.3)
Long-term use of antibiotics	34 (58.6)
Presence of urinary catheterization	37 (63.7)
Diabetes mellitus	5 (8.6)
Immunosuppression	7 (12)
Neurometabolic disease	8 (13.7)
Cerebral palsy, tracheostomy condition	18 (31)
Renal transplant	1 (1.7)
Presence of central venous catheter	33 (56.8)
Urinary surgical procedure	1 (1.7)
Presence of nephrostomy catheter	1 (1.7)
Urinary stones	4 (6.8)
Neurogenic bladder	4 (6.8)
Receiving total parenteral nutrition	16 (27.5)

Clinical symptoms during the candiduria episodes included fever (55.1%), dysuria (46.5%), flank pain (15.5%), suprapubic tenderness (13.7%), urinary frequency (12%), and urgency (6.8%). The most prevalent risk factors identified were urinary catheterization (63.7%), ICU admission (60.3%), prolonged antibiotic use (58.6%), and the presence of a central venous catheter placement (56.8%). Table 1 provides a comprehensive overview of the identified risk factors.

Concomitant bacterial growth was observed in urine cultures from 12 patients, with *Escherichia coli* identified in 9 (75%) and *Klebsiella pneumoniae* in 3 (25%). Additionally, 3 patients had candidemia caused by *C. albicans*, and 2 patients had concurrent bacteremia (*Acinetobacter baumannii* and *Stenotrophomonas maltophilia*, respectively). Laboratory findings revealed a mean leukocyte count of $12,964 \pm 8,448/\text{mm}^3$, a neutrophil count of $8,297 \pm 6,495/\text{mm}^3$, a urea level of 29.3 ± 26.3 mg/dL, a creatinine level of 0.49 ± 0.29 mg/dL, and a C-reactive protein level of 34.2 ± 25.3 mg/L. Antifungal therapy consisted of fluconazole in 57 patients and caspofungin in 1 patient.

Thirty-seven of 57 patients (63.7%) had urinary catheterization and urinary catheters were removed in all patients diagnosed with candiduria. The median time to urine culture sterilization was 4 days (range: 2-8 days), and the median duration of antifungal treatment was 7 days (range: 4-19 days).

DISCUSSION

Candiduria can present with a wide range of clinical severity. Even though numerous *Candida* species exist, epidemiological investigations consistently highlight five species as the most prevalent causative agents of clinical infections: *C. albicans*, *C. parapsilosis*, *C. tropicalis*, *C. glabrata*, and *C. krusei* (5). A comprehensive patient study

examining 68 candiduria cases revealed *C. albicans* as the predominant organism, accounting for 97% of urine culture isolates (6). In the context of pediatric invasive *Candida* infections, *C. albicans* continues to predominate; however, contemporary clinical observations indicate an emerging trend of increased non-*albicans* species prevalence, with *C. parapsilosis* demonstrating particular prominence in neonatal clinical environments (7). Our findings align with these observations, demonstrating *C. albicans* and *C. parapsilosis* as the predominant species in our cohort.

Non-*albicans* *Candida* species have been associated with an increased risk of candidemia (8). While a strong correlation between candidemia and candiduria has been reported, microbiological investigations suggest that the urinary tract is not the primary source of candidemia (9). In our study, three patients with *C. albicans* candidemia also had *C. albicans* isolated from their urine cultures. This observation may be attributable to the relatively small number of candidemia cases in our cohort.

Previous research conducted on 287 patients with hospital-acquired UTIs found identified *Candida* (52.1%), *Enterococcus* (13%), *E. coli* (11.6%), and *K. pneumoniae* (10.1%) to be the most common pathogens isolated from urine cultures (10). In our sample, 12 (20.6%) patients experienced concurrent bacterial growth (*E. coli* and *K. pneumoniae*) in their urine cultures alongside candiduria.

A retrospective analysis of 32 pediatric and neonatal patients with candiduria delineated several significant risk factors, including neutropenia (45%), low birth weight (21%), chemotherapy (7%), prior surgical intervention (10%), and antibiotic exposure (17%). Furthermore, over 90% of these patients had undergone urinary catheterization, and 26% were concurrently receiving antibiotic treatments (11). Robinson et al. identified intensive care units ICU admission as the most prominent risk factor for candiduria (12). Studies in adult populations have identified anatomical urinary tract abnormalities, underlying diabetes mellitus, broad-spectrum antibiotic use, indwelling urinary catheterization, major abdominal surgery, ICU admission, advanced age, and female sex as risk factors for candiduria (13). In another study focusing on invasive *Candida* infections, at least one risk factor was present in 91.1% of patients. Factors associated with mortality included prolonged hospitalization, underlying immunodeficiency, malignancy, heart failure, central venous catheter use, permanent urinary catheter use, total parenteral nutrition, and dialysis. Conversely, antifungal therapy was associated with improved survival. This study also identified chronic lung disease, permanent urinary catheter use, central venous catheter use, and the absence of enteral nutrition as risk factors for *Candida* colonization (7). Our study's identified risk factors for candiduria largely mirror those reported in the

literature. Most importantly, no candiduria-related mortality was observed in our cohort.

CONCLUSION

Understanding local epidemiological characteristics and predisposing risk factors is paramount in the comprehensive management of invasive candidiasis, particularly when determining empirical therapeutic interventions. Clinical practitioners should maintain must exercise heightened diagnostic vigilance when evaluating pediatric patients exhibiting multiple risk factors for candiduria, particularly in settings involving especially in settings characterized by prolonged hospitalization, ICU and invasive medical procedures. The findings of this investigation emphasize the critical necessity of implementing systematic surveillance and individualized therapeutic approaches in addressing urinary tract candidiasis among pediatric populations.

Etik Kurul: Ethical approval for this study was granted by the Necmettin Erbakan University Faculty of Medicine Ethics Committee (approval number 2024/5269).

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