An overview of Candida auris in Iraq: the silent killer

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ABSTRACT. Candida auris is an emerging pathogen known for its high mortality compared to other fungal diseases in healthcare units. Since its initial description in Japan in 2009, C. auris has been reported worldwide, including in Middle Eastern countries. Iraq, one of the Middle Eastern countries, does not seem to have adequately addressed C. auris as a serious emergent pathogen in the healthcare units, especially since numerous healthcare facilities in the Middle Eastern region have reported C. auris infections. Additionally, this pathogen poses unique challenges in the area due to its ability to resist multiple antifungal agents, causing serious invasive infections with high mortality rates. Efforts to control C. auris in Middle Eastern countries have primarily focused on infection surveillance, implementing infection prevention and control measures, and developing regional guidelines for diagnosis and management. However, the challenges associated with its detection, including misidentification and a lack of standardized diagnostic methods, have complicated these efforts. Understanding the epidemiology and molecular characteristics of C. auris in the Middle East is crucial for effective management and control. In conclusion, the combination of its multidrug resistance, high mortality rate, and the challenges of detecting and treating C. auris requires immediate attention and the implementation of comprehensive surveillance and prevention strategies, especially in Iraq. Despite concerted efforts by health agencies and national authorities, Iraq lacks a comprehensive surveillance system and a clear strategy to combat this pathogen effectively, making this fungus a significant threat to Iraq’s healthcare systems.

Keywords: emerging fungus; Candida auris; Middle East; multidrug-resistant fungus; invasive fungal infections.

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Introduction

The Candida species cause most fungal infections in humans (Bongomin & Fayemiwo, 2021), and C. albicans is the most common isolate in clinical samples worldwide (Tahmasebi et al., 2023; Silva et al., 2023; Notarte et al., 2023; Erami et al., 2023), recently, Candida non-albicans isolates, as C. krusei, C. parapsilosis, C. tropicalis, and C. glabrata, have significantly increased in clinical specimens (Deorukhkar et al., 2014); and researchers have begun to pay close attention to them because they produce an array of enzymes and metabolites, serve as probiotics, and being used in food, pharmaceuticals, and detergents industries (Silva et al., 2009; Deorukhkar et al., 2014; Ramdin, Chibabhai, Saggars, Bandini, & Ballot, 2023; Vargas-Espindola et al., 2023; Notarte et al., 2023) and one of the most important species of these isolates is Candida auris, which has had considerable attention in the last decade (Sticchi et al., 2023).

Approximately 200 Candida species exist, but few cause infections in humans when their immune systems are compromised or debilitated (Spampinato & Leonardi, 2013). As a commensal pathogen, C. albicans inhabits the gastrointestinal tract, the genitourinary tract, the oral cavity, and the conjunctiva, among many other locations. However, it causes infection when the host becomes debilitated or immunocompromised. These infections can be superficial, affect the skin or mucous membrane, invade the bloodstream and disseminate to internal organs (Spampinato & Leonardi, 2013). Other Candida species found in healthy individuals include C. parapsilosis, C. glabrata, C. tropicalis, and C. krusei. All five mentioned species cause more than 90% of invasive candidiasis (Turner & Butler, 2014). Several species within the Candida genus are now recognized as having sexual or parasexual characteristics in addition to asexual form (Alby & Bennett, 2010; Reedy, Floyd, & Heitman, 2009). Some diploid asexual Candida species undergo a parasexual cycle, which involves mating between diploid cells of opposite mating types and loss of chromosomes (Turner & Butler, 2014).
Candida auris is a new species in the Candida genus. It was reported in 2009 as a case of ear infection in Japan and has since been reported in several countries (Satoh et al., 2009). Based on the Centers for Disease Control and Prevention data, C. auris is reported in more than 40 countries on all continents except Antarctica (Geremia, Brugnaro, Solinas, Scarpato, & Panese, 2023; Crea et al., 2019; Plachouras et al., 2020; Sharma & Chakrabarti, 2020; Shariq, Rasheed, Alghsham, & Abdulmonem, 2023), including the United States, United Kingdom, India, South Africa, Asia, and Australia (Rhodes & Fisher, 2019; Szekely et al., 2019; Du et al., 2020; Černáková, Roudbary, Brás, Tafaj, & Rodrigues, 2021), and the number of cases is still rising worldwide (Du et al., 2020). Nowadays, in the healthcare field, C. auris has caused significant concern due to its ability to cause high mortality rates in invasive infections, resistance to multiple antifungal agents, and ability to persist in healthcare environments, in addition to the increasing number of recorded infections cases with this fungus (Geremia et al., 2023).

Candida auris is distinct from other Candida species in its genetic makeup, virulence, and antifungal resistance profile. In particular, the genetic similarity index of C. auris from different Candida species ranges from 82% in C. lusitaniae to 39% in C. rugosa, while the similarity index for C. albicans is 43% (Jeffery-Smith et al., 2018). Regarding virulence, C. auris is more aggressive and antifungal resistant than all other Candida species. (Du et al., 2020; Hernando-Ortiz et al., 2021; Bravo Ruiz & Lorenz, 2021; Gao et al., 2021). Some recent studies reported high mortality rates associated with C. auris infections, ranging from 30% to 59% (Lockhart et al., 2017; Osei Sekyere, 2018). It is thought that it is due to the difficulty in treating the infections and the underlying comorbidities of the affected patients. C. auris resists several antifungal agents, including echinocandins and polyenes, commonly used to treat fungal infections worldwide and in Iraq (Gao et al., 2021; Bravo Ruiz & Lorenz, 2021). This multidrug-resistant profile of this fungus has led to treatment challenges and increased mortality rates in infected patients. Therefore, C. auris infections are considered serious in hospitalized patients, particularly those with debilitated immune systems. In addition to spreading easily, this fungus can survive for long periods on surfaces in healthcare settings. Therefore, healthcare facilities need proper strategies and infection control measures to prevent it from spreading (Geremia et al., 2023).

The emergence of C. auris as a global health threat has prompted increased surveillance and research efforts to better understand this fungal pathogen’s epidemiology, transmission, and treatment (Sticchi et al., 2023; Bravo Ruiz & Lorenz, 2021). Several outbreaks of C. auris infections have been reported worldwide, and there are concerns that C. auris may become endemic in some regions, like some antibiotic-resistant bacteria (Du et al., 2020; Jeffery-Smith et al., 2018; Barber et al., 2023).

In Iraq, there is no available data on C. auris infections, no systematic studies have been conducted, and no clear strategy for dealing with this disease exists (Ahmad & Alfouzan, 2021). This study reviews the available databases about this pathogen in Iraq to fill this gap.

Material and methods

Literature and reports from international databases, including Medline [http://pubmed.gov/], Scopus [https://www.scopus.com/], Global Health-CINAHIL [https://www.ebsco.com/products/research-databases/cinahl-complete], CDC [data.CDC.gov], and the official Iraqi virtual library [ivsl.org/ivsl?func=feedback&language=ar], were examined to find the requested information about C. auris. The search was limited to confirmed data and publications in English and Arabic, and unconfirmed case reports and any other cases that did not follow a standard procedure in detection and reporting were excluded. The articles were reviewed for epidemiology and information about C. auris, particularly in Iraq; furthermore, personal contacts with nationwide colleagues were performed for any documented data to be included in this article.

The global prevalence of Candida auris infections

Diferent Clinical settings, including hospitals, intensive care units, and community facilities, have reported C. auris infections (Ahmad & Alfouzan, 2021). The exact transmission mode is not fully understood, but contact with contaminated surfaces or equipment is believed to transmit and persist C. auris to patients and healthcare workers. Additionally, C. auris can colonize healthy individuals’ skin and mucous membranes, possibly contributing to its spread.

Candida auris outbreaks have been reported in many countries across most continents. However, the outbreaks’ intensity varies from country to country. (Figure 1) (Chen et al., 2020). Globally, five genetically distinct clades of C. auris were detected (Clades I, II, III, IV, and V). In contrast, most outbreaks were reported by Clades I, III, and IV, and research proves that there is an association between these genetic clades and their geographic distribution throughout the world (Lockhart et al., 2017; Chow et al., 2020; Muñoz et al., 2021; Ahmad & Asadzadeh, 2025).
Surveillance of the emerging fungus *Candida auris* in Iraq

One of the key factors contributing to the global prevalence of infections caused by this fungus is its ability to colonize and persist in healthcare facilities (Sabino, Veríssimo, Pereira, & Antunes, 2020). *C. auris* has been found to survive on various surfaces, including hospital equipment and medical devices, for an extended period; this persistence allows the pathogen to spread easily from one person to another in healthcare units, making it challenging to control (Ahmad & Asadzadeh, 2023; Sabino et al., 2020). Furthermore, the global prevalence of *C. auris* infections is influenced by challenges in detecting and identifying this fungus. It can be easily misidentified or undetected by traditional laboratory methods (Ahmad & Asadzadeh, 2023; Kim et al., 2009; Lee et al., 2011). All this has made *C. auris* infections a cause for global concern among healthcare professionals and researchers.

**Prevalence of Candida auris infections in Middle Eastern countries**

The prevalence of *C. auris* infections in the Middle East has become a growing concern due to the high mortality rate associated with the pathogen (Mohsin et al., 2020). A systematic analysis of the origin of infected cases was complicated because most Middle Eastern countries lacked epidemiological surveys and documentation systems. For the few cases with available data, the Middle Eastern countries (Kuwait, Jordan, Saudi Arabia, Oman, Qatar, and the United Arab Emirates) were mentioned (Table 1). Of note, there was also one cross-border transfer within the European Union/European Economic Area (EU/EEA) of an Iraqi patient’s nationality with a *C. auris* infection (Steinmann, Schrauzer, Kirchhoff, Meis, & Rath, 2021). Surprisingly, no documented instances of *C. auris* infection have been found in other Middle Eastern and North African (MENA) countries, including Iraq and Jordan (Osei Sekyere, 2018; Osman et al., 2020).

**Discussion**

In recent years, *Candida auris* has emerged as an emerging multidrug-resistant fungus that poses a serious threat to public health with high mortality rates, particularly in healthcare facilities (Alvarado et al., 2021; Abastabar et al., 2019). In light of its global importance and the lack of data regarding this fungus in Iraq, where it has yet to be documented, coupled with its widespread prevalence in most Middle Eastern countries, investigating this microorganism in Iraq is a crucial undertaking that necessitates prompt attention due to its direct implications for the health of those afflicted.
### Table 1. Registration date of Candida auris infection cases in Middle Eastern countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuwait</td>
<td>2014</td>
<td>(Emara et al., 2015)</td>
</tr>
<tr>
<td>Oman</td>
<td>2017</td>
<td>(Al-Siyabi et al., 2017)</td>
</tr>
<tr>
<td>UAE</td>
<td>2018</td>
<td>(Alatoom et al., 2018)</td>
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<tr>
<td>Saudi Arabia</td>
<td>2018</td>
<td>(Abdalhamid, Almaghribi, Althawadi, &amp; Omrani, 2018)</td>
</tr>
<tr>
<td>Qatar</td>
<td>2018</td>
<td>(Shaukat et al., 2021)</td>
</tr>
<tr>
<td>Iran</td>
<td>2018</td>
<td>(Chow et al., 2019)</td>
</tr>
<tr>
<td>Israel</td>
<td>2014</td>
<td>(Ben-Ami et al., 2017)</td>
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<tr>
<td>Turkey</td>
<td>2021</td>
<td>(Kurt et al., 2021)</td>
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### Conclusion

While there have not been reports of C. auris infection in Iraq, this fungus may be present in healthcare facilities in the country. Healthcare workers and authorities should remain vigilant and take proactive measures to prevent and control C. auris infections. In general, preventing and controlling C. auris infections requires a multifaceted approach, including strict adherence to infection control measures, antibiotic stewardship, and healthcare and education and training of staff are also important (Ahmad & Asadzadeh, 2023) in addition to an effective surveillance system for tracking C. auris infections, especially since the fungus’ exact mode of transmission and pathogenesis is unclear. However, increased surveillance and research efforts are needed to contain its spread, develop effective treatment strategies, and improve proactive epidemiological surveillance and detection measures to control and screen for C. auris infection in Iraq.

### References


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