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AN OVERVIEW OF INFECTION PREVENTION AND CONTROL OF CANDIDA AURIS

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Abstract:

The rising prevalence of immunocompromised patients and the high incidence of candidiasis have made Candida auris a significant issue in critical care medicine, as it is the most common cause of fungal infections. The Infection Prevention and Control working group of the International Society of Antimicrobial Chemotherapy convened a meeting of experts in infection prevention and mycology to assess guidelines for healthcare workers regarding infection prevention and control measures for C. auris in inpatient healthcare facilities. The predominant interventions encompassed screening, implementation of standard precautions, thorough cleaning and disinfection, transportation of patients within the hospital, management of outbreaks, decolonization procedures, and provision of medication.

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INTRODUCTION:

Candida auris (C. auris) is a very resilient fungal pathogen that has been linked to numerous outbreaks of infections acquired in healthcare settings worldwide. Candida auris has become a significant issue in the field of healthcare and has garnered more attention in recent years [1]. Candida auris commonly induces serious bloodstream and other infections, mostly among susceptible people.Consequently, it has been linked to exceedingly high rates of illness and death [2]. Moreover, the strong ability to cause disease and the ability to withstand the effects of multiple antifungal medications may lead to the ineffectiveness of treatment. Due of its strong resistance to regular environmental cleaning, HPV is very likely to be transmitted and persist in hospitals. The presence of these characteristics can pose a significant barrier in effectively managing an outbreak of Candida auris in a healthcare setting [3,4].

The rising number of immunocompromised patients has led to Candida auris becoming a significant worry in critical care medicine. Candidiasis, which is the most common cause of fungal infections, is particularly worrisome. COVID-19 patients who are admitted to the hospital are susceptible to healthcare-associated infections (HAIs), such as candidemia, which refers to bloodstream infections caused by Candida [6]. Certain strains of C. auris have the ability to form clusters both inside a laboratory setting and within a living organism. This clustering enables the fungus to avoid detection by the host's immune system, dodge attacks by neutrophils, survive in host tissues, and exhibit greater resistance to antifungal treatments [7]. Several investigations have documented healthcare-associated infections attributed to C. auris [8,9].

Saudi Arabia has reported four instances of Candida auris, as documented in two separate case reports from Dammam and Makkah. The reported patients consistently exhibited prolonged and intricate hospital stays, which encompassed critical care, administration of antibiotics, surgical interventions, and installation of medical devices. Considering the difficulties in confirming Candida auris in laboratories of various hospitals, it is likely that these two findings only reveal a small portion of the Candida auris problem in Saudi Arabia [10,11].

This narrative review aims to provide a comprehensive description of C. auris contamination in healthcare settings, as well as the potential hazards of infection and the necessary preventative and control strategies.

DISCUSSION:

C. auris, similar to other Fungi, is an aerobic eukaryotic creature that obtains nutrients from organic matter and has chitin in its cell walls. This organism is commonly seen in connection with organic materials. C. auris is a haploid fungus that has cells with a spherical or oval shape, measuring 2–3 × 2.5–5 µm. Unlike most other Candida species, C. auris often grows as a yeast (**Figure 1**). Recently, researchers have found that C. auris exhibits phenotypic plasticity, enabling it to possess a three-way phenotypic switching system. Remarkably, utilizing this novel system, C. auris has the ability to transition between its usual yeast form, a yeast form capable of filamentation, and a filamentous form based on specific circumstances [12]. The latter form would be suppressed at the standard human body temperature of 37 °C and, conversely, preferred at lower temperatures (26 °C). C. auris thrives at temperatures ranging from 40 to 42 °C and is capable of surviving in various environments and alkaline circumstances. However, it is unable to tolerate anaerobic conditions. The transition of C. auris from an environmental fungus to a human pathogen can be attributed to the excessive use of antifungal drugs or the organism's ability to adapt to changes in temperature caused by climate change [13,14]. The notion of an environmental origin is based on the fact that the fungus exhibits tolerance to high temperatures and hypersaline conditions before it becomes harmful to humans [15]. The thermotolerance of C. auris is believed to be a trait that enables birds to carry the fungus to rural areas where humans and birds frequently interact. From there, it can easily spread to urban environments, including healthcare facilities [16].

Candida auris is genetically related to Candida haemulonii and Candida ruelliae [17]. Four independent clades (South American, African, South Asian, and East Asian) have been found, indicating a recent and almost simultaneous emergence of various clonal populations from different geographic sources [18]. In 2018, a distinct representative of a potential fifth group was discovered in Iran. This group is distinguished from the previous groups by more than 200,000 single-nucleotide variations and is vulnerable to the three main categories of antifungal medications. The isolate was obtained from ear swab specimens collected from a patient with no history of international travel [19].

Figure 1: Morphology of cells of the microbial organism *C. auris*

C. auris has been documented on all continents since its identification in 2009. Nevertheless, a more thorough analysis of strains associated with Candida haemulonii (C. haemulonii) has revealed a documented instance of bloodstream infection caused by C. auris as far back as 1996 [20]. Although isolated sporadic cases of C. auris occur, there is an increasing prevalence of clusters and outbreaks. This raises concerns about the potential for C. auris to create large nosocomial outbreaks. It is probable that Candida auris was spreading amongst patients even before the initial cases of clinical illness were identified [21]. Typically, C. auris is not usually identified until several days or weeks after a patient is admitted to the hospital, allowing the fungus to spread widely within healthcare institutions [22]. Candida auris can maintain its viability for several months on environmental surfaces and equipment, most likely because of the development of desiccated biofilms [23]. Candida auris poses significant challenges in terms of environmental cleaning and the removal of the fungus from patients [24]. The eradication of C. auris appears to be more challenging compared to other fungal species and bacteria. Healthcare facilities have attempted several strategies to eliminate colonization in patients, but have not achieved success. Furthermore, it should be noted that not all environmental disinfectants have the ability to completely eliminate C. auris [23]. At present, the Centers for Disease Control and Prevention and Public Health England have provided guidelines for the management of patients with C. auris. Both guidelines endorse the implementation of routine precautions for multidrug-resistant pathogens including Clostridium difficile [20,21]. Nevertheless, current recommendations for efficient infection prevention and control (IPC) strategies, diagnostics, patient decolonization, and treatment rapidly become obsolete due to the accumulation of knowledge [22].

C. auris infections have been reported in over 35 countries worldwide, including all continents except Antarctica [22]. Candida auris has emerged as the second most prevalent cause of yeast-related bloodstream infections in certain hospitals, following Candida tropicalis [25]. Whole-genome sequencing of

C. auris has revealed the existence of four distinct populations (clades) in which isolates group together based on their geographic location. All documented infections around the world so far have been confirmed to belong to one of these four clades [19]. A new clade has been discovered recently, which differs from the next closest group by more than 200,000 single nucleotide polymorphisms (SNPs) [19]. The majority of patients documented in areas where the disease is not commonly seen have contracted the infection either while traveling or through contact with the local healthcare system, such as in South Asia [19].

Accurate identification and reporting of C. auris is essential for ensuring the best possible patient care, treatment, and implementation of appropriate infection prevention and control measures. Susceptibility testing should be conducted on all isolates, regardless of the body site, due to the presence of differing levels of resistance. Candida auris is a type of yeast that reproduces via budding. It produces colonies that are white, pink, or purple on CHROMagar, making it challenging to differentiate from C. glabrata. It lacks the ability to create germ tubes and only occasionally develops short pseudo hyphae. Certain strains exhibit cellular aggregation while others do not. Unlike most other Candida species, this particular one thrives in higher temperatures (40–42 °C) and can withstand salt concentrations in the growth media of up to 10%. This can be utilized to create specific media, such as SDA-A that is supplemented with 10% salt for screening purposes [26]. Currently, the use of chromogenic yeast agar for direct screening from swabs has not been verified. Initial efforts to detect C. auris using PCR straight from swabs have yielded several instances of 'false positive' results, when the PCR test indicates a positive result but the culture swabs show a negative result (as communicated by Schelenz). The initial study documented three instances of hospital-acquired bloodstream infections caused by C. auris in South Korea [27]. It revealed that this type of yeast is frequently misdiagnosed as C. haemulonii and Rhodotorula glutinis when utilizing conventional phenotypic techniques.

Based on the Royal Brompton hospital's experience in the UK, the screening locations that most commonly yield positive cultures for C. auris are the armpit and groin. This finding was also validated in the analysis of the New York outbreak [26]. During the outbreak at La Fe University hospital in Spain, C. auris predominantly colonized the rectum and urine, as indicated by unpublished data from Pemán et al. Additional locations for screening, albeit with lower sensitivity to colonization, include the nose, mouth, external ear canals, urine catheter, and wounds. In order to ensure thorough screening, patients with open wounds and/or intravascular catheters should be included in the screening process, in addition to the areas where swabbing is done. Nevertheless, it is crucial to solely swab unsealed wounds, excluding those covered by a wound covering. Unsealing a closed wound can pose a potential danger for patients to acquire colonization of C. auris if they are carriers. Screening for multidrug-resistant organisms (MDRO) in the axilla is not commonly done, making it challenging to establish a screening method specifically for this area [26].

Infection prevention and control

There have been reports of healthcare-associated infections caused by C. auris. In future, the risk of invasive infections caused by C. auris may increase as the number of co-morbidities in today's patients increase every year. In order to be ready for an initial instance of C. auris, healthcare facilities must establish a screening routine and ensure the implementation of sufficient infection prevention and control protocols. Any identification of C. auris should be promptly reported to the infection control department, resulting in the early implementation of rigorous infection prevention and control measures. Patients who have been colonized or infected with C. auris should be placed in isolation until they are discharged and should be marked for monitoring for a minimum of 1 year following the initial negative screening culture. It is crucial to ensure that the status of patients with C. auris is communicated when they are transported within an institution or to other healthcare institutions. Screening of direct contacts should begin when the first case is detected, including those who are being discharged from the healthcare facility. This may require tracing back during the patient's admission if there were any internal transfers. Every patient should be screened in the axilla and groin, in- cluding any additional relevant locations (e.g. nose, urine, rectum, throat, wounds and catheter exit sites). Patients who have been colonized or infected with C. auris should be isolated in a single room with "contact precautions." It is preferable for this room to have negative pressure, and ideally, it should also have an ante-room and an en-suite bathroom/toilet. If the latter option is unavailable, patients should utilize a designated restroom or a waterless cleansing product, together with a designated toilet seat. Utilizing an isolation room with an ante-room may be more desirable, not due to the assumption of airborne transmission, but because adherence to isolation protocols could potentially be higher, as the presence of double doors serves as a constant reminder. There should be a visible system in place to indicate the necessity for isolation at the entrance of the patient's room. Additionally, instructions for healthcare workers (HCWs) and visitors should be readily accessible. It is recommended that all biomedical supplies and equipment be used as disposable items. If they are reusable, they should be kept in the patient's room until discharge and subjected to comprehensive cleaning. Transferring biomedical supplies and equipment to other wards increases the likelihood of further transmission. When it comes to mattresses and pillows, healthcare workers (HCWs) should make sure that they are completely sealed before using them for a patient with C. auris. Additionally, the condition of the mattresses and pillows should be evaluated when the patient is discharged, especially if they are going to be used for another patient [19].

Proper hand hygiene is crucial in order to avoid the spread of any microorganism, including C. auris. When taking care of patients in isolation, it is crucial to ensure strict adherence to proper hand hygiene. Hand hygiene should be conducted at the location where care is provided, with an alcohol-based hand rub that adheres to the European Standard EN 1500. This standard has been proven to effectively eliminate C. auris from hands [28]. Although alcohol-based hand rub is the preferred option, water and soap should be utilized when hands are obviously dirty, and a designated sink must be available for handwashing.

Furthermore, it is imperative to clean and disinfect high-touch surfaces at least twice daily. The rooms must undergo meticulous terminal cleaning and disinfection when the patient is discharged. Several investigations have demonstrated the efficacy of sodium hypochlorite, at concentrations of 1000 ppm or above, in eliminating C. auris [28]. Nevertheless, sodium hypochlorite compounds of high potency, particularly those with a concentration of 5000 parts per million (ppm), might pose a significant toxicity risk to personnel and are exclusively used for terminal cleaning purposes. A study conducted by Ledwoch et al. revealed that several commercially available products, including sodium hypochlorite products, demonstrated ineffectiveness against dry biofilm containing C. auris [18]. Additional effective disinfectants and techniques include peracetic acid, hydrogen peroxide at a concentration of less than 1%, and vaporized hydrogen peroxide [29]. When choosing a product, users should consider the toxicity of the product and opt for one that is safer to use in close proximity to a patient. Additional products, such as those containing ethyl alcohol at a concentration of 29.4% and phenols, may have some effectiveness against C. auris. However, current research about their efficacy is limited. Nevertheless, a concentration of 70 grams per percent of alcohol effectively eliminates C. auris and can be used on limited surfaces such as spills. Some quaternary ammonium disinfectants, such Lysol all and Virex II 256, may not be effective against C. auris. The efficiency of these disinfectants may vary depending on their precise composition [30].

Currently, there is insufficient evidence about the efficacy of topical treatments in managing skin colonization. As part of several therapies, a 2% chlorhexidine washcloth or a 4% chlorhexidine solution were utilized in a significant outbreak in the UK to manage skin shedding [12]. Nevertheless, even with regular chlorhexidine bathing, patients in the UK remained colonized with C. auris [12]. Chlorhexidine solutions can cause skin dryness, which may result in extended colonization by C. auris. Nevertheless, certain individuals continue to be consistently colonized, potentially because of re-colonization from bedding, as Candida spp. have been observed to endure on polyester fabrics for a maximum of 8 days. This strategy has been employed in other epidemics as well [28].

Recent studies have investigated the impact of skin disinfectants on biofilms. These studies have shown that chlorhexidine is effective in combating both the floating and attached communities of C. auris. Therefore, it is recommended to use chlorhexidine at standard concentrations (ranging from 0.05% to 4.0%) for cleansing and disinfecting the skin and wounds to control C. auris topically. Additional research has also shown that chlorhexidine at concentrations ranging from 0.125% to 1.5% is effective. However, it is important to note that the presence of alcohol in these investigations may have influenced the observed outcomes [31]. Work done on octenidine dihydrochloride on (more susceptible) planktonic forms of C. auris has indicated efficacy; however, this may not trans- late to the clinical context [31].

CONCLUSION:

Candida auris represents a progression in the development of pathogens that are resistant to many drugs, expanding beyond bacterial resistance to include this newly identified fungal pathogen with multiple drug resistance. Acquiring knowledge and exchanging information regarding the method of spreading, ability to survive on surfaces, and occurrence in patients and communities would aid in reducing the risk posed by C. auris. During the past ten years, C. auris has originated separately in four distinct groups and has spread globally, with different levels of occurrence in different regions. The risk factors associated with acquiring and being infected include the utilization of invasive medical devices, being admitted to intensive care units, recent surgical procedures, the administration of parenteral nourishment, and the use of broad-spectrum antibiotics and antifungals. The majority of cases have been linked to transmission within hospital settings, with suggestive evidence indicating that the density of colonization and the presence of a contaminated environment are significant factors contributing to the likelihood of transmission. Thorough investigation is needed to determine the most effective ways for preventing infection. However, current recommendations include scrupulous hand washing, implementing contact precautions, and paying careful attention to environmental cleaning.

REFERENCES:

1. de Cassia Orlandi Sardi J, Silva DR, Soares Mendes-Giannini MJ, Rosalen PL. Candida auris: epidemiology, risk factors, virulence, resistance, and therapeutic options. Microb Pathog 2018;125:116–121.
2. Osei Sekyere J. Candida auris: a systematic review and meta-analysis of cur- rent updates on an emerging multidrug-resistant pathogen. Microbiol Open 2018;7(4):e00578.
3. Cortegiani A, Misseri G, Fasciana T, Giammanco A, Giarratano A, Chowdhary A. Epidemiology, clinical characteristics, resistance, and treat- ment of infections by Candida auris. J Intensive Care 2018;6:69.
4. Forsberg K, Woodworth K, Walters M, et al. Candida auris: the recent emergence of a multidrug-resistant fungal pathogen. Med Mycol 2019; 57:1–12.
5. Dudiuk C, Berrio I, Leonardelli F, et al. Antifungal activity and killing kinetics of anidulafungin, caspofungin and amphotericin B against Candida auris. J Antimicrob Chemother 2019;74:2295–2302.
6. Sabino R., Veríssimo C., Pereira Á.A., Antunes F. *Candida auris*, an Agent of Hospital-Associated Outbreaks: Which Challenging Issues Do We Need to Have in Mind? *Microorganisms.* 2020;8:181.
7. Du H., Bing J., Hu T., Ennis C.L., Nobile C.J., Huang G. *Candida auris*: Epidemiology, biology, antifungal resistance, and virulence. *PLoS Pathog.* 2020;16:e1008921.
8. Theodoropoulos N.M., Bolstorff B., Bozorgzadeh A., Brandeburg C., Cumming M., Daly J.S., Ellison R.T., 3rd, Forsberg K., Gade L., Gibson L., et al. *Candida auris* outbreak involving liver transplant recipients in a surgical intensive care unit. *Am. J. Transpl.* 2020;20:3673–3679.
9. Logan C., Martin-Loeches I., Bicanic T. Invasive candidiasis in critical care: Challenges and future directions. *Intensive Care Med.* 2020;46:2001–2014.
10. Abdalhamid B, Almaghrabi R, Althawadi S, Omrani A. First report of Candida auris infections from Saudi Arabia. J Infect Public Health 2018;11:598–599.
11. Elsawy A, Alquthami K, Alkhutani N, Marwan D, Abbas A. The second con- firmed case of Candida auris from Saudi Arabia. J Infect Public Health 2019;12:907–908.
12. Fernandes L., Ribeiro R., Henriques M., Rodrigues M.E. *Candida auris*, a singular emergent pathogenic yeast: Its resistance and new therapeutic alternatives. *Eur. J. Clin. Microbiol. Infect. Dis.* 2022;41:1371–1385.
13. Mohsin J., Weerakoon S., Ahmed S., Puts Y., Al Balushi Z., Meis J.F., Al-Hatmi A.M.S. A Cluster of *Candida auris* Blood Stream Infections in a Tertiary Care Hospital in Oman from 2016 to 2019. *Antibiotics.* 2020;9:638.
14. Casadevall A., Kontoyiannis D.P., Robert V. Environmental *Candida auris* and the Global Warming Emergence Hypothesis. *mBio.* 2021;12:e00360-21.
15. Watkins R.R., Gowen R., Lionakis M.S., Ghannoum M. Update on the Pathogenesis, Virulence, and Treatment of *Candida auris*. *Pathog. Immun.* 2022;7:46–65.
16. Escandón P. Novel Environmental Niches for *Candida auris*: Isolation from a Coastal Habitat in Colombia. *J. Fungi.* 2022;8:748.
17. Satoh K., Makimura K., Hasumi Y., Nishiyama Y., Uchida K., Yamaguchi H. *Candida auris* sp. nov., a novel ascomycetous yeast isolated from the external ear canal of an inpatient in a Japanese hospital. *Microbiol. Immunol.* 2009;53:41–44.
18. Lockhart S.R., Etienne K.A., Vallabhanni S., Farooqi J., Chowdhary A., Govender N.P., Colombo A.L., Calvo B., Cuomo C.A., Desjardins C.A., et al. Simultaneous emergence of multidrug-resistant *Candida auris* on 3 continents confirmed by whole-genome sequencing and epidemiological analyses. *Clin. Infect. Dis.* 2017;64:134–140.
19. Chow N.A., de Groot T., Badali H., Abastabar M., Chiller T.M., Meis J.F. Potential Fifth Clade of *Candida auris*, Iran, 2018. *Emerg. Infect. Dis.* 2019;25:1780–1781.

20. Kim MN, Shin JH, Sung H, Lee K, Kim EC, Ryoo N, et al. *Candida haemulonii* and closely related species at 5 university hospitals in Korea: identification, antifungal susceptibility, and clinical features. Clin Infect Dis 2009;48:e57–61.
21. Chowdhary A, Voss A, Meis JF. Multidrug-resistant *Candida auris*: 'new kid on the block' in hospital-associated infections? J Hosp Infect 2016;94:209–12.
22. Chowdhary A, Anil Kumar V, Sharma C, Prakash A, Agarwal K, Babu R, et al. Multidrug-resistant endemic clonal strain of *Candida auris* in India. Eur J Clin Microbiol Infect Dis 2014;33:919–26.
23. Ledwoch K, Maillard JY. Candida auris Dry Surface Biofilm (DSB) for Disinfectant Efficacy Testing. Materials (Basel) 2018;12.
24. Abdolrasouli A, Armstrong-James D, Ryan L, Schelenz S. In vitro efficacy of disinfectants utilised for skin decolonisation and environmental decontamination during a hospital outbreak with *Candida auris*. Mycoses 2017;60:758–63.
25. Mathur P, Singh PK, Malhotra R, Walia K, Chowdhary A. Five-year profile of candidemia at an Indian Trauma Center: high rates of *Candida auris* blood stream infections.Mycoses 2018;61:674–80.
26. Adams E, Quinn M, Tsay S, Poirot E, Chaturvedi S, Southwick K, et al. *Can- dida auris* in Healthcare Facilities, New York, USA, 2013-2017. Emerg Infect Dis 2018;24:1816–24.
27. Lee WG, Shin JH, Uh Y, Kang MG, Kim SH, Park KH, et al. First three re- ported cases of nosocomial fungemia caused by *Candida auris*. J Clin Microbiol 2011;49:3139–42.
28. Vallabhaneni S, Kallen A, Tsay S, Chow N, Welsh R, Kerins J, et al. Investi- gation of the First Seven Reported Cases of *Candida auris*, a Globally Emerg- ing Invasive, Multidrug-Resistant Fungus-United States, May 2013-August 2016. MMWR 2017;65:1234–7.
29. Cadnum JL, Shaikh AA, Piedrahita CT, Jencson AL, Larkin EL, Ghannoum MA, et al. Relative Resistance of the Emerging Fungal Pathogen *Candida auris* and Other *Candida Species* to Killing by Ultraviolet Light. Infect Control Hosp Epi- demiol 2018;39:94–6.
30. Rutala WA, Kanamori H, Gergen MF, Sickbert-Bennett EE, Weber DJ. Suscepti- bility of *Candida auris* and *Candida albicans* to 21 germicides used in healthcare facilities. Infect Control Hosp Epidemiol 2019;40:380–2.
31. Cadnum JL, Shaikh AA, Piedrahita CT, Sankar T, Jencson AL, Larkin EL, et al. Ef- fectiveness of Disinfectants Against *Candida auris* and Other *Candida Species*. Infect Control Hosp Epidemiol 2017;38:1240–3.