

Candida auris: An Emerging Antibiotic-Resistant Threat

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Editor's Choice

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Abstract

- ❖ *Candida auris* is a fungal pathogen that can cause serious infection in humans.
- ❖ According to the Centers for Disease Control and Prevention (CDC), *C. auris* is an emerging global health threat and has been isolated in over 40 countries.
- ❖ Clinical signs of *C. auris* infections include bloodstream infections, myocarditis, urinary tract infection, surgical wound infections, and skin abscesses.
- ❖ Microbiologists hypothesize *C. auris* biofilm formation increases resistance to drugs.
- ❖ Hospitalized ICU patients have a higher risk of contracting *C. auris* infection, which is especially seen with the current COVID-19 pandemic.
- ❖ The Minnesota Department of Health (MDH) and CDC are conducting surveillance of *C. auris* in hopes of preventing future outbreaks.

Author's Note:

Candida auris is an emerging fungal pathogen deemed the second largest global public health threat in the US by the Centers for Disease Control and Prevention (CDC), as it can cause severe infections and is antibiotic-resistant. *C. auris* cases have been on the rise, especially during the current COVID-19 pandemic, since hospitalized patients and nursing home residents are at high-risk for *C. auris* infections. The Minnesota Department of Health (MDH) announced statewide surveillance of this drug-resistant yeast in 2019 as more cases are being discovered around the world. With more public awareness regarding this severe threat, we can hopefully begin to increase our knowledge around this fungus and prevent future outbreaks.



Figure 1: *Candida auris* (Image courtesy of CDC/Stephanie Rossow) [1].

Candida auris: An Emerging Antibiotic-Resistant Threat [Fact Sheet]

Definition and Pathogenesis

- ❖ Invasive candidiasis is a type of disease caused by infectious yeast, such as *Candida auris* [1].
 - Usually, yeast can become opportunistic pathogens within the human body to cause candidiasis; however, *C. auris* is not commonly found within the gastrointestinal tract compared to other *Candida* species [2].
 - Other pathogenic *Candida* species include *C. albicans*, *C. tropicalis*, and *C. parapsilosis* [3].
- ❖ *Candida auris* is a fungal pathogen that belongs to the *Candida/Clavispora* clade and can cause infection in humans via bloodstream [3, 4].
 - It can be transmitted from person-to-person contact.
 - It can also be transmitted through contact with contaminated surfaces, as it can survive up to 7 days on moist or dry surfaces.
 - It can colonize on skin, favoring the axilla and groin [2].
- ❖ *C. auris* infection may occur in the bloodstream, wounds, and urinary tract [5].
- ❖ *C. auris* is able to evade the innate immune response (e.g., neutrophils), allowing growth to persist and leading to the formation of biofilms [2].

Epidemiology

- ❖ The Centers for Disease Control and Prevention (CDC) considers *C. auris* an emerging global health threat.
 - *C. auris* is the second biggest antibiotic-resistant threat in the U.S., after Carbapenem-resistant *Acinetobacter* [6].
- ❖ As of December 31, 2020, a total of 1,678 clinical cases were reported in the U.S.

- Initial cases of *C. auris* infection in the U.S. derived from international travel and later spread across U.S. health care facilities [1].
- ❖ The annual case fatality rate is estimated as 20-60% globally among individuals infected with *C. auris* [3, 4].
 - Nosocomial outbreaks have occurred in South Korea, India, South Africa, Europe, and the U.S. since its initial discovery in 2009 [3, 7].
- ❖ *C. auris* has been isolated in over 40 countries worldwide [3].
- ❖ The global prevalence of *C. auris* infection is unknown due to the phenotypic resemblance of *C. auris* to other *Candida* species (such as *C. haemulonii*), leading to misdiagnosed cases [2, 7].

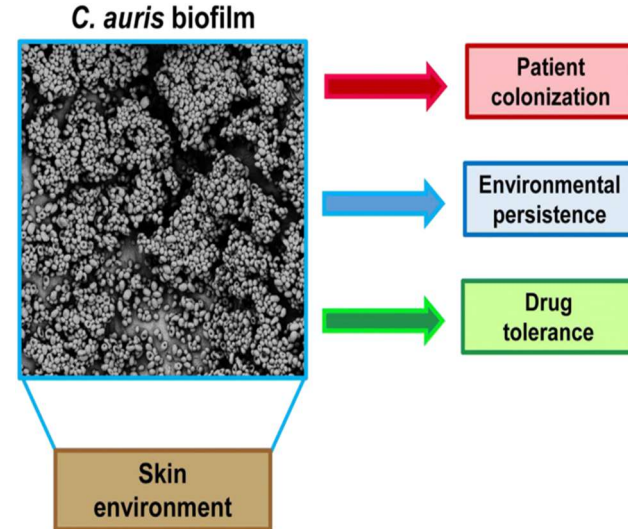


Figure 2: *C. auris* biofilm on porcine skin ex vivo (Image courtesy of Current Clinical Microbiology Reports - authors Mark Horton and Dr. Jeniel Nett).⁵ Creative Commons license - <http://creativecommons.org/licenses/by/4.0/>.

Mechanism of *C. auris* Biofilms

- ❖ Biofilm formation is a pathophysiologic mechanism of *C. auris* that mediates antifungal drug usage as a risk factor [3].
- ❖ *C. auris* colonizes on skin to create biofilms with an extracellular matrix [5].
- ❖ Biofilm formation increases tolerance against drugs (e.g., triazole, fluconazole) [5].
- ❖ Polysaccharides of the extracellular matrix isolate and prevent antifungal drugs from accessing the intracellular complex of *C. auris* [5].
- ❖ Increased efflux pump activity of transporters *MDR1* and *CDR1* in *C. auris* appear to contribute to drug resistance [5].

Etiology

- ❖ *C. auris* was first isolated from the ear canal of a patient in Japan, which is how its name was derived [2].
- ❖ *C. auris* can grow in temperatures ranging from 37-42°C, which is why the human body provides optimal growth conditions [2].
 - This trait is different from other *Candida* species.
- ❖ Biofilm formation occurs with *C. auris* at a higher density, compared to other *Candida* species, on the outside layer of skin [2].
 - *C. auris* adheres to surfaces via biofilms, and microbiologists hypothesize its virulence and drug-resistance may be increased by biofilm formation [2].
- ❖ Clinical signs of *C. auris* infections are bloodstream infections, myocarditis, urinary tract infection, surgical wound infections, burn infections, skin abscesses, otitis, meningitis, and bone infections [2].
 - *C. auris* infection leads to symptoms of fever and sepsis [5].

Risk Factors

- ❖ As the infection spreads nosocomially, hospitalized ICU patients are deemed to be high-risk for *C. auris* infection [2].
- ❖ Other risk factors include elderly age, patients who received surgery within 30 days, the presence of an indwelling medical device (such as a catheter), an immunosuppressed state (e.g., HIV/AIDS or

chemotherapy patients), hemodialysis, blood transfusion, and chronic renal disease [2, 3].

- ❖ The use of antibiotics or antifungal drugs is a major risk factor for *C. auris* infection, and evidence is supported by studies performed in various countries [3].
 - A retrospective cohort study conducted in Shenyang, China concluded that tetracycline therapy was a statistically significant risk factor for infection compared to patients who were neither infected nor colonized by *C. auris* [7].
 - A 12-month case-control study with 228 patients in Valencia, Spain isolated fluconazole-resistant (antifungal-resistant) *C. auris* [8].
 - A prospective cohort study of 27 ICUs in India discovered that prior antifungal exposure in 74 reported cases of invasive candidiasis was significantly associated with *C. auris* [OR 2.8 (1.6–4.8); $P < 0.001$] [9].

Public Health Intervention

- ❖ The Minnesota Department of Health (MDH) has been requesting *C. auris* isolates since June 2016, and in August 2019, MDH announced a statewide surveillance.
 - Health care professionals are required to report detection of *C. auris* or any *Candida* species that may potentially be *C. auris* in order to prevent misdiagnosis.
 - Patients infected with *C. auris* are advised to isolate in private rooms and clinicians are advised to follow contact precautions, such as use of personal protective equipment (PPE) and routine disinfection of contact surfaces [10].
- ❖ The CDC has worked with other organizations to create new tests for identifying *C. auris* in a timely manner.
 - After learning that *C. auris* spreads in hospitals, the CDC also worked with health care facilities and health departments across the nation to contain and prevent outbreaks of these drug-resistant infections [6].
 - State and local public health departments in the U.S. should report suspected cases of *C. auris* to the National Notifiable

Diseases Surveillance System (NNDSS) through the CDC [1].

- ❖ Clinical trials for antifungal treatment, such as ibrexafungerp (SCY-078), may inhibit *C. auris* biofilm formation [5].
- ❖ With the COVID-19 pandemic, the increase in hospitalizations has led to a higher at-risk population for *C. auris*.
 - *C. auris* infection was found in 2.5% of COVID-19 ICU patients in New Delhi, India.
 - Hospitals are urged to identify and treat *C. auris* infections to reduce deaths among COVID-19 patients and the burden on health care workers [11].

Summary

- ❖ *C. auris* is the second largest emerging global health threat due to antibiotic resistance and nosocomial infection.
- ❖ Prior antifungal treatment is a major risk factor to *C. auris* and is mediated by biofilm formation.
- ❖ CDC and MDH have been working with health care facilities to maintain the spread of *C. auris*, especially during the COVID-19 pandemic.
- ❖ Future studies may lead to the development of new drugs that can inhibit biofilm formation in order to treat *C. auris* infections.

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References

- [1] Centers for Disease Control and Prevention. (2020, October 28). *Candida auris*. <https://www.cdc.gov/fungal/candida-auris/index.html>
- [2] Sikora A, Zahra F. *Candida Auris*. [Updated 2020 Oct 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK563297/>
- [3] Du H, Bing J, Hu T, Ennis CL, Nobile CJ, Huang G. (2020, October 22). *Candida auris*: Epidemiology, biology, antifungal resistance, and virulence. *PLOS Pathogens*. <https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1008921>
- [4] Webster M, Habte B, Davis T. (2020, September 4). Fungus Amungus [Audio Podcast]. Radiolab. <https://www.wnycstudios.org/podcasts/radiolab/articles/fungus-amungus>
- [5] Horton MV, Nett JE. *Candida auris* Infection and Biofilm Formation: Going Beyond the Surface. *Curr Clin Micro Rpt* 7, 51–56 (2020). <https://doi.org/10.1007/s40588-020-00143-7>
- [6] Centers for Disease Control and Prevention. (2020, October 28). Biggest Threats and Data: 2019 AR Threats Report. <https://www.cdc.gov/drugresistance/biggest-threats.html#auris>
- [7] Tian S, Rong C, Nian H, Li F, Chu Y, Cheng S, et al. First cases and risk factors of super yeast *Candida auris* infection or colonization from Shenyang, China. *Emerg Microbes Infect*. 2018;7(1):128. Epub 2018 Jul 12. pmid:29992959.
- [8] Ruiz-Gaitan A, Martinez H, Moret AM, Calabuig E, Tasiyas M, Alastruey-Izquierdo A, et al. Detection and treatment of *Candida auris* in an outbreak situation: risk factors for developing colonization and candidemia by this new species in critically ill patients. *Expert Rev Anti Infect Ther*. 2019;17(4):295–305. pmid:30922129
- [9] Rudramurthy SM, Chakrabarti A, Paul RA, Sood P, Kaur H, Capoor MR, et al. *Candida auris* candidaemia in Indian ICUs: analysis of risk factors. *J Antimicrob Chemother*. 2017;72(6):1794–1801. pmid:28333181
- [10] Minnesota Department of Health. (2019). *Candida auris* Information for Health Professionals: Case Definition, Required Reporting and Testing, and Infection Prevention Guidance. <https://www.health.state.mn.us/diseases/candidiasis/auris/hcp/index.html>
- [11] Chowdhary A, Tarai B, Singh A, Sharma A. Multidrug-resistant *Candida auris* infections in critically ill coronavirus disease patients, India, April-July 2020. *Emerg Infect Dis*. 2020;26(11):2694-6. 10.3201/eid2611.203504