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The *C. auris* Epidemic: Understanding its Impact on ICU Patients

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Abstract

***Candida* species are the most common cause of nosocomial fungal infections and the fourth most common cause of hospital-acquired illnesses. Fungal infection has been known to cause severe complications and even death in immunocompromised patients. With the rise in antibiotic resistance and an increase in invasive medical procedures, ICU patients are becoming more vulnerable to this infection. In order to fight this epidemic, it is essential to comprehend the causes, signs, and available treatments for *Candida* species. *Candida* auris is an exceptionally rare type of fungus that first surfaced in 2009 and poses a threat to global health. *C auris*-associated invasive infections have a greater mortality rate than infections caused by other *Candida* species. *C. auris* possesses a tendency to develop antifungal medication resistance, which would make therapy more challenging. While the precise cause of *C. auris* illnesses is uncertain, it is believed that healthcare workers can contract the illness by touching infected objects or surfaces. Medical professionals, nurses, and various other staff members all contribute significantly to preventing the transmission of *C. auris* infestations. Utilizing hand hygiene techniques like thorough hand washing or hand sanitizers that contain alcohol can significantly reduce the spread of fungi. It is crucial to provide healthcare workers with ongoing instruction in infection control, the proper use of antifungal medications, and the early identification of *C. auris* infections.**

Keywords: Intensive Care Unit, Nurses, Hygiene, Antifungal, Invasive, *Candida*

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INTRODUCTION

Infections with fungi have become a threat to human health on a worldwide scale. Around 1.7 billion people globally suffer from a fungus infection, with the majority of instances being mucosal and superficial skin infections.[1] *Candida* species are the most common cause of nosocomial fungal infections and the fourth most common cause of hospital-acquired illnesses. Globally, around 400,000 bloodstream infections caused by *Candida* species occur each year, with death rates surpassing 40%.[1,2] Fungal infection has been known to cause severe complications and even death in immunocompromised patients. With the rise in antibiotic resistance and an increase in invasive medical procedures, ICU patients are becoming more vulnerable to this infection.[3] To fight this epidemic, it is essential to comprehend the causes, signs, and available treatments for *Candida* species.[4] Immuno-compromised individuals, such as organ transplant recipients, those with hematologic malignancies, and HIV-positive individuals, are far more likely to develop systemic fungal infections. In the United States, the rate of nosocomial fungal infections has increased from 2 to 3.8 per 1000 discharges. The most prevalent isolate in ICU patients and contributing to 8–15% of nosocomial bloodstream infections was identified to be *Candida* spp.[5] India is one of the developing nation with a diverse climate that supports a wide range of fungi illnesses. With the emergence of new fungal infections like Apophysomyces elegans, the prevalence of candidemia, systemic aspergillosis, cryptococcosis, and zygomycosis has substantially increased in India.[6-8]

C. auris in ICU patients

Candida is a type of yeast that is present in the human body and is usually harmless. However, when the immune system is compromised, *Candida* can cause infections, particularly in hospitalized patients.[9] *C. auris* is an exceptionally rare type of fungus that first surfaced in 2009 and poses a threat to global health.[10] It can cause severe infections in those who are susceptible and is resistant to several antifungal medications. *C auris*-associated invasive infections have a greater mortality rate than infections caused by other *Candida* species. *C auris* infections have a 30% to 72% crude fatality rate.[11,12]

Due to their compromised immune systems, prolonged hospitalizations, and the consumption of invasive healthcare tools such as catheterization and ventilators, ICU patients are more likely to get *C. auris* infections.[13] Antibiotics with a broad spectrum of action can eliminate beneficial microbes, creating an environment where *Candida* can thrive. *C. auris* illnesses are often treated with antifungal drugs; however, due to a growing number of strains that are tolerant to antifungals therapy has become more challenging Resistance to antifungal drugs by *C. auris* is well-documented and is one of the main drivers of its pathogenicity. *C. auris* exhibits consistently high fluconazole minimal inhibitory concentrations (MICs) and variable susceptibility to the other triazoles, echinocandins, and amphotericin B. Indeed, *C. auris* is the first *Candida* species to be classified as multidrug resistant (MDR). Of even greater concern is the emergence of *C. auris* strains that are pan-resistant, although novel antifungals such as ibrexafungerp and fosmanogepix have demonstrated in vitro and in vivo efficacy against *C. auris*.[14]

Causes of *C. auris* infections

While the precise cause of *C. auris* illnesses is uncertain, it is believed that healthcare workers can contract the illness by touching infected objects or surfaces.[16] Patients in intensive care units are particularly susceptible to getting infected due to their reduced immunity and the invasive medical treatments they must endure.[15] Misusing antibiotics can foster a situation where *Candida* can flourish and develop treatment resistance. Cancer, diabetes, and HIV/AIDS are among additional indicators of risk for *C. auris* outbreaks. Patients who were given bone marrow or organ transplants are also more susceptible to infection. Patients in intensive care units are at high risk for infections related to healthcare, especially those connected to intensive medical treatments. Various additional professional concerns arise while thinking about *C. auris* illnesses.

Healthcare Environment: *C. auris* outbreaks can propagate more quickly in healthcare. Equipment, polluted surfaces, and medical gadgets can all act as fungal reservoirs. To

avoid transmission, good hygiene practices, such as routine sanitation and disinfection processes, are essential.[16]

Practices of Healthcare Workers: Medical professionals, nurses, and various other staff members all contribute significantly to preventing the transmission of *C. auris* infestations. Utilizing hand hygiene techniques like thorough hand washing or hand sanitizers that contain alcohol can significantly reduce the spread of fungi.[17] In addition, medical personnel should adhere to the proper guidelines for handling and maintenance of obtrusive equipment to lower the possibility of infection.[18]

C. auris possesses a tendency to develop antifungal medication resistance, which would make therapy more challenging.[19] Abuse or overuse of antifungal medications, especially in ICU circumstances, might result in an outbreak of drug-resistant strains.[20] Medical professionals need to practice excellent antimicrobial administration to deal with this, which involves utilizing antifungal medications cautiously and by recommended treatment guidelines.[21]

Medical professionals need to practice excellent antimicrobial administration to address this, which includes taking antifungal medications cautiously and by recommended treatment norms. Diagnostic Difficulties: It can be challenging to distinguish *C. auris* infections due to its resemblance to other species of *Candida* and the limitations of conventional diagnostic testing. Healthcare professionals need to be knowledgeable about their clinical appearance, risk factors, and appropriate diagnostic techniques to accurately identify and manage these infections.[22]

Multidisciplinary Strategy: To effectively treat *C. auris* outbreaks in ICU patients, infectious disease specialists, microbiologists as well chemical scientists, and other physicians must work together. For the purpose of making an accurate diagnosis, choosing the best course of treatment, and keeping track of a patient's response to therapy, cross-disciplinary collaboration is essential.[23]

Comprehensive infection prevention and control techniques must be employed to lower the incidence of *C. auris* infections. The use of personal protective equipment, stringent hand hygiene standards, routine fungal infection surveillance, and extensive disinfection and cleaning of healthcare facilities are all part of this.[16]

Training and Education: It is crucial to provide healthcare workers with ongoing instruction in infection control, the proper use of antifungal medications, and the early identification of *C. auris* infections. By staying up to date with the most recent research and recommendations, healthcare professionals can enhance their understanding of risk factors, prevention measures, and treatment options for these illnesses.[24]

In conclusion, medical staff who perform in ICU settings need to have a solid understanding of the risk factors, modes of transmission, diagnostic challenges, and available prevention measures for *C. auris* outbreaks. By focusing on infection control procedures, cautious antifungal medication use, and interdisciplinary collaboration, healthcare providers can successfully manage and reduce the impact of *C. auris* outbreaks on terminally sick patients.

Symptoms of *C. auris* infections

According to the type and degree of the infection, different *C. auris* infections will present with different symptoms. Frequent signs involve fever, chills, and exhaustion. Additionally, patients may develop oral thrush, nail infections, or skin rashes. A serious infection with *C. auris* can fail the organs, septic shock, and ultimately death.[25]

Given that their symptoms often resemble those of other diseases, *C. auris* lesions can be difficult to diagnose. To verify the diagnosis, a blood test is frequently required. A place of injury or other contaminated location may also be used for culture. To avoid difficulties and lessen the chance of infecting other patients, it is critical to recognize and address *C. auris* infections as soon as possible.[25]

Diagnosis and treatment of *C. auris* infections

Antifungal medicines are often used to treat *C. auris* infections. However, the number of antibiotic-resistant microbes means that there are fewer and fewer therapeutic choices available. To completely get rid of the infection, one may occasionally take an array of antifungal medications. It is crucial to constantly evaluate

Table. Surface disinfectants tested against *C. auris*[16]

Disinfectant	Concen. tested (contact time in minutes)	Effective	Level of evidence
Chlorine	0.39% (1), 0.65% (1), 0.825% (1), 1% (10), 2% (10), 1000 ppm (3, 5, 180, 1800), 10000 ppm (3, 180, 1800)	Yes	Good
Hydrogen peroxide	8 g/m3, 1.4% (1)	Yes	Moderate
Hydrogen peroxide+ silver nitrate	11% (60)	Yes	Low
Phenolics	5%	Yes	Low
Glutaraldehyde	2% (20)	Yes	Low
Alcohols	29.4% (0.5)	Yes	Low
Acetic acid	>5% (3)	No	Low
Peracetic acid	2000 ppm (5, 10)	Yes	Low
Peracetic acid+hydrogen peroxide+acetic acid	1200 ppm/<1% (3)	Yes	Low
Quaternary ammonium compounds	2% didecyldimethyl ammonium chloride (60), alkyl dimethyl ammonium chlorides (10), didecyldimethyl ammonium chloride/ dimethylbenzyl ammonium chloride (10)	No	Low

patients for pharmaceutical side effects and modify treatment as appropriate.[26]

Individuals having *C. auris* infestations require assistance with treatment in addition to medicines, such as feeding and water. To treat severe infections, patients might need to be hospitalized and receive intensive care. Surgery might be required in some circumstances to remove contaminated tissues or medical implants.[27]

Prevention of *C. auris* infections in the ICU

An all-encompassing strategy is necessary for avoiding *C. auris* outbreaks in the ICU. The use of personal protective equipment surface washing and disinfection, are required for preventing infections by healthcare providers. To stop the emergence of *Candida* strains that are resistant to antifungal, the abuse of antibiotics has to be tackled.[28]

Additionally crucial to avoiding infections are healthcare providers' training and education for use of disinfectants used for *C. auris* (Table) Patients need to be informed about the dangers of intrusive medical treatments and the value of good cleanliness. The most recent treatments for *C. auris* outbreaks must be taught to healthcare professionals through continual training and continuing education.[29]

***C. auris* outbreak investigation**

To find the root of the illness and stop it from spreading further, an in-depth investigation is required whenever a *C. auris* epidemic arises in the ICU. This inquiry may entail examining medical documentation and protocols for infection control as well as screening individuals and medical staff whether an outbreak of *C. auris*. To stop further transmission, it could be required to put outbreak control measures into place, including cohorting patients and stepping up the disinfection and cleaning procedures.[30]

The Impact of *C. auris* on ICU Patients

Patients in the intensive care unit are more susceptible to *C. auris* infections due to their weak immune systems. In addition to medical symptoms, patients may also experience emotional disturbances and disturbed life quality. Additionally, there is a possibility for negative outcomes which could lead to prolonged hospital stays and a great risk of fatality.[31]

The expenses of *C. auris* outbreak treatment is very significant for both patients

and healthcare facilities. The rising prevalence of antibiotic-resistant bacteria could result in higher medical expenses and a low ability to treat infections successfully as the hospital stays and intensive care are expensive.[32]

Future outlook and research

The growing frequency of *C. auris* breakouts in ICU patients is causing major problems for health care professionals. Due to the increase in antibiotic-resistant strains and the absence of effective treatments, infection prevention, and control are of the highest importance. The ongoing research is of utmost importance to identify novel treatments and defenses against *C. auris* epidemics.[33]

The rapid detection and treatment of *C. auris* diseases can be facilitated by the development of rapid diagnostic techniques. The possibility of antibiotic resistance and the spread of *C. auris* infections can be reduced through antimicrobial stewardship programs and other infection management techniques.[30,34]

CONCLUSION

Healthcare professionals must be knowledgeable about the causes, symptoms, and treatments of the *C. auris* outbreak to effectively combat it. A multifaceted strategy becomes the need of an hour to avoid infection in the ICU, including measures to prevent infection, patient and healthcare worker education, and ongoing investigations for new treatments and preventive measures. It becomes our prime duty to inform the healthcare providers of the recent research to safeguard the patients and stop the spread of *C. auris* infections.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

ETHICS STATEMENT

Not applicable.

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