Candida auris: An emerging threat

Dr. Victor Leung, MD FRCPC
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Conflicts of Interest

Advisory board: Merck, Pfizer, Paladin, Astra-Zeneca, GSK

Speaker Honorarium: Merck, Pfizer, Biomerieux, Diversey
Outline

Origins and Spread

Surveillance and Outbreaks

Diagnostics

Therapeutics
Origins and Spread
- Isolated from ear canal of 70 year old female in Tokyo in 2009

- Retrospective analysis of clinical isolates identified C. auris in Korea (1996 blood isolate) and in Pakistan in 2008

- SENTRY Antifungal Surveillance (1998-2016) only identified 6 isolates of C. auris out of 20758 Candida isolates

Satoh et al., Microbiology and Immunology 2009. Vol 53 (1)
Cumulative number of countries with reported detection of *Candida auris*
Near Simultaneous Emergence of Distinct Clades of *C. auris*

Clade I - South Asian  
Clade II - East Asian  
Clade III - South African  
Clade IV - South American  
Clade V - Iran

40-200K SNP difference between clades
2-600 SNP differences within clades

Chow et al. MBio. 2020; 11(2)
One Health

- ANIMALS
- PEOPLE
- ENVIRONMENT

Social
Economic
Political
1. Global warming is responsible for raising the ambient climate temperatures, which selects fungal clades that can reproduce at avian and mammalian basal temperatures.

2. Candida auris previously existed as a plant saprophyte that gained thermotolerance and salinity tolerance as a result of the effects of climate change on the wetland ecosystem.

3. Thermotolerant C. auris may have been transplanted by birds across the globe to rural areas where human and birds are in constant contact.

4. Rural environment activities (e.g., farming) provide the opportunity for interspecies transmission of virulent pathogens such as C. auris.

5. Human migration towards urban areas eventually led C. auris into healthcare environments.
WHO - Priority Fungal Pathogens

- Public health threat from fungi is increasing
- Opportunistic infection are becoming increasingly resistant to firstline antifungals
C. auris is phagocytosed by macrophages during innate immune responses.

C. auris evades macrophages by escaping and depleting glucose, which triggers macrophage cell death.

Despite causing macrophage metabolic dysfunction and death, C. auris does not activate robust NLRP3-inflammasome responses, thereby evading antimicrobial inflammation.

Surveillance and Outbreaks
**Canada Communicable Disease Report (CCDR)**

**Visual Abstract**

**CANDIDA AURIS**

**What Health Care Providers Need to Know**

**C. auris is an emerging multidrug resistant fungus**

**It is now in Canada**
- can cause invasive disease
- is difficult to detect
- can spread easily in health care environments

**Who is at risk?**

Those who don't respond to antifungal therapy and have a history of:
- travel-associated healthcare
- a lab result with unidentified/unusual candida species
- a central venous line
- abdominal surgery
- exposure to broad-spectrum antibiotics or antifungals

**Best Practices**

Transfer the patient to a private room and consult:
- infectious disease specialist
- infection prevention and control
- public health

Candida auris in Canada

- First reported case of *C. auris* in Canada was in 2017 in a returned traveler from India.
- First 2 reported cases in Canada received health care in India (both cases colonized/infected with CPE)
- Point prevalence study in Canada in 2018 with 23 acute care hospitals in 6 provinces (CNISP/CHEC): 0.4% (2/488)
  - No hospital contacts were identified

1) Schwartz et al. CCDR 2017
Candida auris Surveillance in Canada

- Canadian Nosocomial Infection Surveillance Program - January 2020 Protocol
- 43 known cases in Canada since 2012
- First reported outbreak in Canada at VCH hospital ICU in 2018 (Clade 1)
- British Columbia, September 2018: C auris added to the list of reportable pathogens to Public Health

Notice: Candida auris interim recommendations for infection prevention and control

Emerging global healthcare-associated fungal pathogen Candida auris (C. auris)

Percentage increase in clinical cases grew each year, from a 44 percent increase in 2019 to a 95 percent increase in 2021.

They also report that colonization screening volume and screening cases increased in 2021 by more than 80 percent and more than 200 percent, respectively.

The number of *C. auris* cases that were resistant to first-line treatment in 2021 was about 3 times that in each of the previous 2 years.
Diagnostics
## Misidentification of *C. auris* by different diagnostic methods

<table>
<thead>
<tr>
<th>Diagnostic method (manufacturer)</th>
<th>Misidentification example(s) (reference[s])</th>
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<tbody>
<tr>
<td><strong>Biochemical</strong></td>
<td></td>
</tr>
<tr>
<td>API 20CAUX</td>
<td><em>Rhodotorula glutinis</em> (5, 21, 33)</td>
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<tr>
<td></td>
<td><em>C. sake</em> (3, 15, 34)</td>
</tr>
<tr>
<td></td>
<td>Unidentified (55)</td>
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<tr>
<td>API Candida</td>
<td><em>C. famata</em> (12)</td>
</tr>
<tr>
<td>Phoenix (BD Diagnostics)</td>
<td><em>C. haemulonii, C. catenulate</em> (31)</td>
</tr>
<tr>
<td>Vitek</td>
<td><em>C. haemulonii</em> (3-5, 7, 12, 14, 15, 26, 27, 33-36)</td>
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<tr>
<td></td>
<td><em>C. lusitaniae</em> (15)</td>
</tr>
<tr>
<td></td>
<td><em>C. famata</em> (3, 27)</td>
</tr>
<tr>
<td>MicroScan (Beckman Coulter)</td>
<td><em>C. famata, C. lusitaniae, C. guillermondii, C. parapsilosis, C. albicans, C. tropicalis</em> (17, 23)</td>
</tr>
<tr>
<td><strong>MALDI-TOF MS</strong></td>
<td></td>
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<tr>
<td>Vitek MS (bioMérieux)</td>
<td><em>C. albicans, C. haemulonii</em> (29)</td>
</tr>
<tr>
<td></td>
<td>Not identified (28, 36)</td>
</tr>
<tr>
<td>MALDI Biotyper (Bruker Daltonics)</td>
<td><em>Neisseria meningitidis</em> serogroup A, <em>Pseudomonas rhizospherae</em> (29)²</td>
</tr>
</tbody>
</table>
For example, this is a mixed culture of *Candida glabrata* (purple), *Candida tropicalis* (navy blue), and *Candida auris* (white, circled in red) on CHROMagar Candida.

*Candida auris* on CHROMagar Candida, here, for example, displays multiple color morphs.
CHROMAgar Candida Plus

- *Candida auris* after 48 h of growth showing light blue colonies with a blue halo around the colonies.
- The combination of the color and the halo are distinct for *C. auris*
BioFire FilmArray Blood Culture Identification 2 (BCID2) Panel

Gram-negative Bacteria
- Acinetobacter calcoaceticus-baumannii complex
- Bacteroides fragilis
- Enteric Bacteria
  - Enterobacter cloacae complex
  - Escherichia coli
  - Klebsiella aerogenes
  - Klebsiella oxytoca
  - Klebsiella pneumoniae group
  - Proteus spp.
  - Salmonella spp.
  - Serratia marcescens
- Haemophilus influenzae
- Neisseria meningitidis
- Pseudomonas aeruginosa
- Stenotrophomonas maltophilia

Gram-positive Bacteria
- Enterococcus faecalis
- Enterococcus faecium
- Listeria monocytogenes
- Staphylococcus spp.
  - Staphylococcus aureus
  - Staphylococcus epidermidis
  - Staphylococcus lugdunensis
- Streptococcus spp.
  - Streptococcus agalactiae (Group B)
  - Streptococcus pneumoniae
  - Streptococcus pyogenes (Group A)

Antimicrobial Resistance Genes
- blaCTX-M
- blaIMP
- blaKPC
- mcr-1
- mecA/C and MREJ
- blaNDM
- blaOXA-48-like
- blaVIM
- vanA/B

Yeast
- Candida albicans
- Candida auris
- Candida glabrata
- Candida krusei
- Candida parapsilosis
- Candida tropicalis
- Cryptococcus neoformans/gattii
Surveillance Cultures

Axilla
Groin
Nares, Ears
Wounds, Lines, Drains
Therapeutics
Limited Therapeutic Options

- 90% of isolates resistant to one antifungal
- 30% of isolates resistant to two antifungals

Azoles
Echinocandins
Polyenes
List P: Antimicrobial Products Registered with EPA for Claims Against Candida Auris

- Sodium hypochlorite
- Hydrogen peroxide
- Hydrogen peroxide + Paracetic Acid
- Dodecylbenzenesulfonic Acid
- Isopropyl Alcohol + Quaternary Ammonium
Summary

- Rapid global emergence
- Often multi-drug resistant
  - Often misidentified
  - Crude mortality ~ 30-60%
- Highly transmissible between patients and environment
- Nosocomial infections/outbreaks