Candida auris: What makes it unique among Candida spp.?

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Outline

• Epidemiology
• Infection control and prevention
• Microbiology
• Clinical characteristics
• Management
Figure 1. A timeline of the spread of Candida auris. Image courtesy L. Leung.
Behaviors observed with *C. auris* set it apart from other *Candida* species

<table>
<thead>
<tr>
<th></th>
<th><em>Candida albicans</em></th>
<th><em>Candida auris</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonization site</td>
<td>Host endogenous flora (GI tract)</td>
<td>Acquisition from another person</td>
</tr>
<tr>
<td>Portal of entry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistence on skin</td>
<td>Not observed (except <em>C. parapsilosis</em>)</td>
<td>Predilection for skin, particularly the axilla and groin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stick and stay</td>
</tr>
<tr>
<td>Tolerance to growth on high temp</td>
<td>Grows poorly at &gt;37C</td>
<td>Grows best at 42C</td>
</tr>
<tr>
<td>Tolerance to growth in NaCl (sweats)</td>
<td>NaCl sensitive</td>
<td>NaCl tolerant</td>
</tr>
<tr>
<td>Hardy in environment</td>
<td></td>
<td>Stick and stay (~<em>Candida parapsilosis</em>)</td>
</tr>
<tr>
<td>Propensity for nosocomial outbreaks</td>
<td>Rare</td>
<td>Common</td>
</tr>
</tbody>
</table>

*C. auris* can **spread between patients** in healthcare facilities and cause **outbreaks**
<table>
<thead>
<tr>
<th></th>
<th><strong>Candida albicans</strong></th>
<th><strong>Candida auris</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Healthcare setting</strong></td>
<td>Acute care</td>
<td>Post-acute or chronic care High-acuity patients</td>
</tr>
<tr>
<td><strong>Host</strong></td>
<td>Opportunistic infection (immunocompromised, neutropenia, disrupted gut integrity, etc)</td>
<td>Prolonged health care High-acuity post-acute care facilities Invasive devices (respirators, trach, etc)</td>
</tr>
<tr>
<td><strong>Risk factors</strong></td>
<td>Central venous catheters GI surgery <strong>Neutropenia</strong> Multiple antibacterial agents</td>
<td>Central venous catheters <strong>MDR bacterial infections</strong> Multiple antibacterial agents Prior antifungals</td>
</tr>
<tr>
<td>Previous colonization</td>
<td></td>
<td>MDR bacteria <strong>Candida auris</strong></td>
</tr>
<tr>
<td>Defense system</td>
<td>PMN is major defense mechanism</td>
<td><strong>Immune evasion (PMN phagocytosis and killing)</strong></td>
</tr>
</tbody>
</table>
Factors contributing to transmission

- Colonize skin and may persist for ≥200 days
- Persist in the hospital environment
- *C. auris* establishes long-term residence within the skin tissue compartment (hair follicle).
- Clades of *C. auris* differ in their abilities to colonize murine skin, mirroring epidemiologic findings.

Huang X et al. Cell Host Microbe 2021:29:210-21
Candida auris

- Growth: within 3 days
- Temperature: 25 – 42°C
- Colony: Smooth and glistening
  White to grey
  Entire margin

CHROMagar Candida (not *C. auris* specific)
- Light blue with a blue halo
- Occasional false-positives with closely related species (*C. vulturna, C. pseudohaemulonii*)

CHROMagar Candida PLUS (*C. auris* specific)

Identification can be difficult

Phenotypic characteristics are not sufficient for identification
Candida auris ID: BIOCHEMICAL SYSTEMS

VITEK (2YST, 2 XL)
Misidentifications:
Candida haemulonii, Candida duobushaemulonii, Candida spp., and Candida auris from African and East Asian clades

API 20C
Misidentifications:
Rhodotorula glutinis, Candida sake, Saccharomyces kluyveri, Saccharomyces cerevisiae, Candida spp.

MicroScan, MicroScan AutoScan, Microscan Walkaway
Misidentifications:
Candida famata, Candida guilliermondii, Candida lusitaniae, Candida parapsilosis, Candida spp., Rhodotorula rubra

RapiID Yeast Plus
Misidentifications:
Candida parapsilosis, Candida spp.

Proteomic Identification

Bruker Biotyper
CA Library Claim 4

Vitek MS
IVD v3.2

Candida auris well represented in MALDI-TOF database libraries and reliably identified

Cernakova L et al. Int J Mol Sci 2021;22(9):4470
Figure 2. Schema representing the most common colonisation, invasive infection sites, and risk factors for deep-seated infections in patients colonised by *C. auris.*
Table 2
Infection prevention and infection control recommendations of the CDC and PHE\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Precautions</th>
<th>Center for Disease Control and Prevention</th>
<th>Public Health England</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single room with standard and contact precautions including gown, gloves, and hand hygiene practices. To the extent possible, minimize the number of staff who care for the \textit{C. auris} patient. If there are multiple \textit{C auris} cases in a facility, consider cohorting staff caring for these patients.</td>
<td>Single room, with \textit{ensuite} facilities when possible, with standard precautions including gloves, aprons, and hand hygiene practices. If a patient needs to be taken out of the room to theatre, procedures should be scheduled as last case of the day and environmental cleaning should be performed afterwards.</td>
</tr>
</tbody>
</table>
Infection Prevention – Duration of contact duration

- INDEFINITELY!!
Infection Prevention – Surveillance screening

• Target screening:
  • Patients with contact with another patient with *C. auris* infection or colonization
  • Transferred from a facility with *C. auris* cases
    • Especially those require high-level of care (ventilator-dependent)
Infection Prevention – Environmental disinfection
<table>
<thead>
<tr>
<th>Registration</th>
<th>Active Ingredient</th>
<th>Product Brand Name</th>
<th>Company</th>
<th>Contact Time (minutes)</th>
<th>Formulation Type</th>
<th>Surface Types</th>
<th>Use sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>10324-214</td>
<td>Hydrogen Peroxide and Paracetid Acid</td>
<td>Maguard 5626</td>
<td>Mason Chemical Company</td>
<td>2</td>
<td>Dilutable</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional; Residential</td>
</tr>
<tr>
<td>1677-226</td>
<td>Hydrogen Peroxide, Paracetid Acid and Octanoic Acid</td>
<td>Virasept</td>
<td>Ecolab Inc.</td>
<td>4</td>
<td>Ready to Use</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional</td>
</tr>
<tr>
<td>1677-237</td>
<td>Hydrogen Peroxide and Paracetid Acid</td>
<td>Oxycide™ Daily Disinfectant Cleaner</td>
<td>Ecolab Inc.</td>
<td>3</td>
<td>Dilutable</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional</td>
</tr>
<tr>
<td>1677-262</td>
<td>Dodecybenzenesulfonic Acid</td>
<td>Disinfectant 1 Spray</td>
<td>Ecolab Inc.</td>
<td>1</td>
<td>Ready to Use</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional</td>
</tr>
<tr>
<td>1677-263</td>
<td>Dodecybenzenesulfonic Acid</td>
<td>Disinfectant 1 Wipe</td>
<td>Ecolab Inc.</td>
<td>1.25</td>
<td>Ready to Use/Wipe</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional</td>
</tr>
<tr>
<td>37549-1</td>
<td>Sodium Hypochlorite</td>
<td>Micro-Kill Bleach Germicidal Bleach Wipes</td>
<td>Medline Industries Inc.</td>
<td>2</td>
<td>Ready to Use/Wipe</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional; Residential</td>
</tr>
<tr>
<td>37549-2</td>
<td>Sodium Hypochlorite</td>
<td>Micro-Kill Bleach Solution</td>
<td>Medline Industries, LP</td>
<td>2</td>
<td>Ready to Use</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional; Residential</td>
</tr>
<tr>
<td>46781-12</td>
<td>Isopropyl Alcohol and Quaternary Ammonium</td>
<td>Cavicide 1</td>
<td>Metrex Research</td>
<td>1</td>
<td>Ready to Use</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional; Residential</td>
</tr>
<tr>
<td>46781-13</td>
<td>Isopropyl Alcohol and Quaternary Ammonium</td>
<td>CaviWipes 1</td>
<td>Metrex Research</td>
<td>1</td>
<td>Ready to Use/Wipe</td>
<td>Hard Nonporous (HN)</td>
<td>Hospital; Institutional; Residential</td>
</tr>
<tr>
<td>46781-14</td>
<td>Sodium Hypochlorite</td>
<td>CaviWipes Bleach</td>
<td>Metrex Research</td>
<td>3</td>
<td>Ready to Use/Wipe</td>
<td>Hard Nonporous (HN)</td>
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Antifungal resistance is common

- > 40% are multi-drug resistant
FIG 1 A timeline of the clinical course of the patient. *Candida auris* isolations at different intervals, including pan-drug-resistant isolates recovered on hospital day 72 are shown. Also highlighted are antimicrobial drugs and duration, major complications, and other pathogens encountered in the patient.
RESISTANCE DEVELOPS NOT UNCOMMONLY DURING THERAPY

FIG 1: A timeline of the clinical course of the patient. *Candida auris* isolations at different intervals, including pan-drug-resistant isolates recovered on hospital day 72 are shown. Also highlighted are antimicrobial drugs and duration, major complications, and other pathogens encountered in the patient.
**Notes from the Field**

**Transmission of Pan-Resistant and Echinocandin-Resistant *Candida auris* in Health Care Facilities — Texas and the District of Columbia, January–April 2021**

Meghan Lyman, MD; Keatlin Forberg, MPH; Jacqueline Beuhren, MHS; Thi Dang, MPH; Rebecca Free, MD; Emma F. Seagle, MPH; D. Joseph Sexton, PhD; Elizabeth Soda, MD; Heather Jones, DNP; Daryl Hawkins, MSN; Adrienne Andemen, MSN; Julie Bassett, MPH; Shawn R. Lockhart, PhD; Eunjiyoung Mereagoa, MD, DePPh; Preecha Iyengar, MD; Brendan R. Jackson, MD; Tom Chiller, MD

*Morbidity and Mortality Weekly Report*

**The New York Times**

**Deadly Fungus Spread Rapidly During the Pandemic, C.D.C. Says**

*Candida auris*, a drug-resistant fungus that health officials hoped to contain is now in more than half the 50 states, according to a new research paper.

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**DC — 101 isolates (Jan-April 2021)**
- 3 skin colonization pan-drug resistant (PDR) isolates
- Facilities: Long-term care for severely ill patients

**Tx — 22 isolates**
- 2 PDR and 5 resistant to both azole and echinocandins
- Facilities in same city: LR-AC (2), 3 ST AC and 2 at both
- 5 colonization and 3 clinical isolates

No previous echinocandin exposure

Transmission of PDR or echinocandin-resistant *C. auris* in US healthcare
First line antifungal

- Echinocandin (beware of emerging ECH-resistance)
- Source control (remove lines)

Monitor clinical improvement

Persistent culture ≥7d

- Check antifungal MIC
- Consider switching to or adding L-AmB (5 mg/kg)

Pan-drug resistance

- Call AMP – Expanded access with novel agents on pipeline
# Outcome

<table>
<thead>
<tr>
<th></th>
<th>Candida albicans and other spp</th>
<th>Candida auris</th>
</tr>
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<tbody>
<tr>
<td>Mortality</td>
<td>30%</td>
<td>39%</td>
</tr>
<tr>
<td>Microbiologic persistence</td>
<td>32%</td>
<td>42%</td>
</tr>
<tr>
<td>Microbiologic recurrence</td>
<td>4%</td>
<td>12%</td>
</tr>
<tr>
<td>Hospitalization stay</td>
<td>10 days</td>
<td>31 days</td>
</tr>
</tbody>
</table>
Hoenig M et al. Drugs 2021;81:1703-29