Candida auris: Update on the Laboratory Investigations

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Mycology Laboratory @ Wadsworth Center: Scope

• **Yeast and Mold Identification**
  - Culture
  - MALDI-TOF MS (Bruker)
  - ITS-PCR/Sequencing
  - Real time PCR assays:
    - *Coccidioides immitis/posadasii*
    - *Histoplasma capsulatum*
    - *Blastomyces dermatitidis*
    - *Exserohilum rostratum*
    - *Candida spp.*
    - *Candida auris*

• **Antifungal Susceptibility Testing**
  - E-tests (Yeasts)
  - Microbroth dilution (Yeasts & Molds)
  - Y09 (Yeasts)

• **Research**
  - *Pseudogymnoascus* (‘bat white nose’)  
  - Fungal virulence mechanisms
  - Antifungal test innovation

• **Surveillance Testing**

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Candida auris Outbreak!
First Reported from Japan, 2009

*Candida auris* sp. nov., a novel ascomycetous yeast isolated from the external ear canal of an inpatient in a Japanese hospital

Kazuo Satoh¹,², Koichi Makimura¹,³, Yayoi Hasumi¹, Yayoi Nishiyama¹, Katsuhisa Uchida¹ and Hideyo Yamaguchi¹

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- High temperature tolerance (45°C)
- High salt tolerance (10%)
- No specific features e.g. chlamydomspore, hyphae, pseudohyphae, etc.
- Unique sugar assimilation profile

Chrome agar  
Gram Stain
Rapid Worldwide Emergence of *Candida auris*
Reason for Concern

Unlike other *Candida* species

- Readily transmitted in hospitals and nursing homes
- Survives on surfaces (weeks), and on skin (months)
- **Level of drug resistance never seen** - some infections have NO traditional treatment options
- High mortality (60%)

*Candida auris* = MRSA
Reason for Concern

- Current diagnostic methods used in the majority of the hospitals are inadequate for *C. auris* ID
MALDI & DNA Sequencing - *Candida auris* ID

MALDI-BRUKER

VITEK 2 YST with Ver 8.01 software (BIOMERIEUX)

Sequencing-Ribosomal gene ITS & D1/D2
Candida auris in NY from August 2016
Endemic or Transient?

Clinical cases (105)
Screening cases (116)
Screening → Clinical (4)

94 facilities including 35 hospitals, 55 LTCFs, 1 LTACH, and 1 hospice
Candida auris misidentified

Candida haemulonii (VITEK2)

C. auris (92%)

C. duobushhaemulonii (7%)

C. haemulonii (1%)

Candida famata = C. auris (single isolate)
C. auris Resistance Profile

- **Fluconazole**: 99% resistance
- **Fluc+Amph B**: 36% resistance
- **Fluc+Echino**: 1.4% resistance

Majority of NY isolates belong to the South Asia Clade

Ribosomal genes – ITS & D1/D2

East Asia

South America

South Asia
Point Prevalence Survey (August 2016......

**Initial Screening**
- Axilla/Groin composite Swab
- Nares

**Advance Screening**
- Axilla
- Groin
- Nares
- Rectal
- Wound (if any)
- Urine

**SWABS**

**SPONGES**
- Healthcare objects
- Pre and Post-cleaned
Surveillance Samples: Aug 2016 - Oct 2017

PATIENT (SWABS)

ENVIRONMENTAL (SPONGES)

TOTAL

SPONGES 3917

SWABS 2009
Laboratory Workflow

Surveillance samples (sponges & swabs)

- Non selective agar medium (SAB+)
  - Growth
    - MALDI
    - Candida auris & Candida spp.
  - Sequencing of the ribosomal gene (ITS)
    - (Phylogenetic Analyses)
  - Antifungal susceptibility testing

- Selective agar (salt+dulcitol)
  - Growth
    - MALDI
    - Candida auris
  - No Growth
    - Negative culture

- Selective broth (salt + dulcitol)
  - Cloudy
  - SAB+
    - No Growth
    - Growth
      - MALDI
      - Candida auris

Real-time PCR assay
TAT = 4 h
Candida spp. Identified from Surveillance Samples
Development and validation of a real-time PCR assay for rapid detection of *Candida auris* from surveillance samples
L. Leach, Y. Zhu, S. Chaturvedi

**Journal of Clinical Microbiology** *(in press)*

<table>
<thead>
<tr>
<th>Real-time PCR results</th>
<th>Culture results</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
<th>PPV</th>
<th>NPV</th>
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<td>Positive</td>
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<td>46</td>
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<tr>
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<td>Negative</td>
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<td>Negative</td>
<td>26</td>
<td>(89 - 100)</td>
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</tbody>
</table>
What We Have Done in Last One Year

- Developed protocol for sample collection (swabs and sponges) for the Point Prevalence Study
- Developed protocol for sample collection (swabs) for the Admission Screening
- Implemented protocol for culture of surveillance samples with selective and non-selective media
- Expanded MALDI-TOF database for *C. auris* by addition of well-known clades and NY isolates
- Implemented microbroth dilution and E-test methods for antifungal susceptibility testing
- Developed *C. auris* real-time PCR assay for quick presumptive diagnosis
Community Outreach: Alerts and Webinar

8/17/16 - “Global Emergence of Invasive Infections Caused by the Multidrug-Resistant Yeast Candida auris”

11/3/16 - “Identification and Reporting of Suspected Candida auris Isolates”

8/30/17 - Webinar – “Candida auris Epidemiology and Laboratory Testing for Addressing this Emerging Pathogen”
Outreach: Public Health Laboratories

- PCR protocol & webinar slides - New York City Public Health Laboratory – (September 2017)
- PCR protocol, *C. auris* isolates, other *Candida* spp., positive & negative swabs - Memorial Sloan Kettering Cancer Center (August 2017)
- *Candida* spp. for MALDI validation – New York Presbyterian Hospital (November 2017)
- *Candida* Survey - Public Health Laboratories in the Northeast Region for wet workshop (September 2017)
- MALDI, PCR protocols, *C. auris* isolates, other closely related *Candida* spp. & bicoid plasmid - Connecticut Department of Public Health Laboratory (August 2017)
- *C. auris* isolation protocol (January 12, 2017), PCR protocol & bicoid plasmid - CDC (July 2017)
Continuing Challenges

- *Candida auris* real-time PCR – Manual Extraction - Need high throughput approaches *(Currently underway)*
- Commercial media containing dulcitol **not available**
- Clinical laboratories **need to update** their VITEK 2 YST with Ver 8.01 software *(BIOMERIEUX)*
- Do not report *Candida* spp. (especially from sterile sites). If you **cannot**, send to Reference Laboratories
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