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Concise Communication

Persistent colonization of *Candida auris* among inpatients rescreened as part of a weekly surveillance program

Sebastian P. Arenas MPH, CIC[1], Patrice J. Persad PhD[1], Samira Patel MBA[1], Dipen J. Parekh MD[1,3], Tanira B.D. Ferreira MD[1,4], Mirian Farinas BSN, RN[1], D. Joseph Sexton PhD[5], Meghan Lyman MD[5], Hayley B. Gershengorn MD[1,4,6] and Bhavarth S. Shukla MD, MPH[1,2]

[1]University of Miami Health System, Miami, Florida, [2]Division of Infectious Diseases, Department of Internal Medicine, University of Miami Miller School of Medicine, Miami, Florida, [3]Department of Urology, University of Miami Miller School of Medicine, Miami, Florida, [4]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, University of Miami Miller School of Medicine, Miami, Florida, [5]Mycotic Diseases Branch, Centers for Disease Control and Prevention, Atlanta, Georgia and [6]Division of Critical Care, Department of Medicine, Albert Einstein College of Medicine, Bronx, New York

Abstract

We established a surveillance program to evaluate persistence of *C. auris* colonization among hospitalized patients. Overall, 17 patients (34%) had ≥1 negative result followed by a positive test, and 7 (41%) of these patients had ≥2 consecutive negative tests.

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Candida auris is an emerging and often multidrug-resistant fungal pathogen that persistently colonizes patients and spreads in healthcare settings.[1–4] Studies have described duration of *C. auris* colonization in postacute care facilities (PACFs) and outside healthcare settings.[5,6] However, few data are available regarding its persistence among hospitalized patients, in whom colonization can increase the risk for developing *C. auris* candidemia. For instance, in one study, among 157 *C. auris* colonized patients in an intensive care unit, 27 (17%) patients developed *C. auris* candidemia and 7 of these patients developed a recurrent episode.[7] To expand our understanding of persistence of colonization, we share the findings of an ongoing *C. auris* surveillance program implemented to meet screening requests from PACFs before patient transfer and to evaluate changes in screening results among colonized patients while hospitalized.

Methods

Our surveillance program involved patients hospitalized in a 560-bed tertiary-care medical center in Miami, Florida who were known to be colonized with *C. auris* or were newly identified from admission screenings, point prevalence surveys (PPSs), or clinical cultures from a sterile and/or nonsterile body site. Admission screening criteria were met if a patient had a tracheostomy and/or arrived from a ventilator-capable PACF.[6] All colonized patients were placed in a cohort in single-occupancy rooms of a 30-bed unit where daily cleaning was performed according to the institution's protocol for patients on contact precautions for multidrug-resistant organisms (MDROs). Specifically, a hydrogen-peroxide–based disinfectant from the Environmental Protection Agency (EPA) List P was used daily as well as terminal cleaning with UV-C disinfection. This retrospective cohort study included all cases with at least 1 positive *C. auris* screening or clinical test and who were admitted to the *C. auris*–designated ward during the surveillance period. None of the patients were involved in a *C. auris* decolonization protocol, but patients with central lines did receive chlorhexidine gluconate (CHG) bathing according to policy. Each patient was counted only once. The surveillance screening program began on December 13, 2021, and remains active to date; however, the end of the data analysis period was set at July 26, 2022. Follow-up patient screening was conducted initially twice weekly until discharge and later transitioned to weekly due to swab shortages. Screening was performed using rt-PCR from axilla and groin composite swabs[5–8] via an on-site, laboratory-validated, BioGx *C. auris* BD Max instrument (REF 350-070-C-MAX), and samples were collected by trained nurses assigned to the ward. We retrospectively evaluated baseline characteristics and clinical and outcomes data from the electronic medical record (EMR). The University of Miami Institutional Review Board approved this analysis (no. 20210224).

Results

In total, 50 colonized patients from the surveillance program during the analysis period were reviewed. The median age was 68 years (interquartile range, 61–78), and 31 patients (62%) were identified as colonized on admission (Table 1). The remaining 19 patients were identified during their hospitalization. Also, 37 patients (74%) were admitted directly from PACFs, of whom 33 (89%) came from facilities with known ongoing transmission of *C. auris*. Of the 50 patients, 28 (56%) had a prior hospitalization within 1 year of their index admission. The median number of occasions that patients were tested was 10.5 (IQR, 4–23), with a median of 9 positive results (IQR, 4–19) and 950 days as the

Corresponding author: Sebastian P. Arenas; Email: s.arenas@med.miami.edu
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Table 1. Characteristics of Cohort

Characteristics	Total (N=50), No. (%)[a]
Demographics[b]	
Sex, male (%)	28 (56)
Age, median y [IQR]	68 [61–78]
Race/ethnicity (%)	
Non-Hispanic Black	20 (40)
Non-Hispanic White	5 (10)
Asian	1 (2)
Hispanic (White, Black, or Other)	24 (48)
Screened positive on admission	31 (62)
Transfer from a facility with ongoing transmission[c]	33 (66)
Admissions based on type of postacute care facility	
Skilled nursing facility	13 (26)
Ventilator-capable skilled nursing facility	7 (14)
Long-term acute care	17 (34)
No. of admissions from an outside acute-care hospital	2 (4)
No. of admissions from home/assisted-living facility	10 (20)
Direct transfers from a healthcare facility abroad	1 (2)
History of hospitalization within 1 year of index admission	28 (56)
History of COVID-19 hospitalization within 6 mo of index admission	8 (16)
Conditions[b]	
Diabetes	26 (52)
Chronic kidney disease	6 (12)
Neurological conditions	17 (34)
Solid-organ tumor	3 (6)
Exposures[b]	
Indwelling devices present within 14 d before *C. auris* positivity:	
Mechanical ventilation	23 (46)
Tracheostomy	27 (54)
Urinary catheter	24 (48)
Central venous catheter	22 (44)
Surgically inserted feeding tube	25 (50)
Hemodialysis 14 d before *C. auris* positivity	9 (18)
Intensive care unit-level care at any point during index admission	33 (66)
Receipt of systemic antibiotics 14 d before *C. auris* positivity	28 (56)
Known history of colonization with carbapenem-resistant organisms within 6 mo of *C. auris* positivity	12 (24)
Clinical outcomes	
Hospital length of stay, median d [IQR]	85 [31–311]
Developed *C. auris* bloodstream infection	5 (10)
Disposition	
Remained admitted in the hospital by end of data analysis period	18 (36)
Home or assisted-living facility	7 (14)
Skilled nursing facility	7 (14)
Ventilator-capable skilled nursing facility	0 (0)
Long-term acute care	8 (16)
Died	10 (20)
Surveillance program	
C. auris tests in total per patient, median [IQR]	10.5 [4–23]

Note. IQR, interquartile range.
[a]Data are no. (%) unless otherwise specified.
[b]Manually abstracted from electronic medical record.
[c]Based on admission screening program data capturing different transfer locations and designation of high-risk facilities.

maximum length of time from first positive to last positive result. Furthermore, 18 patients (36%) were still admitted at the end of the analysis period, and 10 patients (20%) died; however, none of the patients who died had *C. auris* invasive infections documented at the time of death.

In total, 17 (34%) of the colonized patients had at least 1 negative result followed by a positive result, and of those, 7 (41%) had ≥2 consecutive negative results. For instance, case patient number 26 had 7 consecutive negative results followed by 1 positive result (Fig. 1). Of the 7 patients with ≥2 consecutive negative results, 2 patients (29%) remained negative up to discharge or the end of the data analysis period: case patient number 40, with 7 consecutive negative results, and case patient number 49, with 34 consecutive negative results (Fig. 1).

During their admission, 5 patients (10%) developed *C. auris* candidemia. Among them, 3 were identified as colonized prior to developing *C. auris* candidemia (median days to *C. auris* candidemia from colonization, 51; IQR, 31–81). The fourth and fifth patients did not have prior documented *C. auris* history and did not meet criteria for *C. auris* screening on hospital admission. The fourth patient (no. 33) was identified due to *C. auris* candidemia on admission to the hospital and the fifth patient (no. 34) developed *C. auris* candidemia during hospitalization. Of these 5 patients, 3 had peripherally inserted central catheters, and 2 of these 3 were on mechanical ventilation at the time of identification. Also, 2 of these patients were discharged home, 1 was transferred to a PACF, and 1 died in the hospital 125 days after *C. auris* candidemia clearance. The last remaining patient continued to be admitted after the analysis period ended and had the longest length of stay (LOS) of the cohort (958 days).

Discussion

Our data demonstrate the persistence of *C. auris* colonization and support findings of prolonged colonization among hospitalized patients, even after occasional negative results, as reported in prior studies in different settings.[6,7] In our experience, PACFs routinely request *C. auris* screenings prior to transfer and rely on these results to accept or decline new patients. This situation highlights concerns about using negative results as criteria to transfer patients or remove contact precautions because 1 or multiple negative results may not ensure that a patient is no longer colonized.[9]

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ID	Total Number of Tests	Positive Tests	BSI Prior to start of colonization testing	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Disposition	Percent Positive
1	2	2		1	1																																Admitted	100%
2	2	2		1	1																																Discharged	100%
3	2	2		1	1																																Discharged	100%
4	2	2		1	1																																Discharged	100%
5	2	2		1	1																																Discharged	100%
6	3	3		1				1		1																											Discharged	100%
7	3	3		1	1	1																															Expired	100%
8	3	3		1		*			1	1																											Expired	100%
9	3	3		1	1	1																															Admitted	100%
10	4	3		2	1	0																															Discharged	75%
11	4	4		1	1	2																															Discharged	100%
12	4	4		1	1	1	1																														Admitted	100%
13	4	4		1	1	1	1																														Discharged	100%
14	4	4		1	1	1	1																														Admitted	100%
15	4	4		1	2	1																															Expired	100%
16	5	4		1	1	1				1	0																											Expired	80%
17	5	5		1	1	1	1	1																													Discharged	100%
18	5	5		1	1	1	1	1																													Discharged	100%
19	5	5		2		1	1	1																													Discharged	100%
20	6	6		1	1	1	1	1	1																												Admitted	100%
21	7	7		1	2	1	1	1	1	1																											Discharged	100%
22	9	8		1	0	1	1	1	1	1	1	1																									Discharged	89%
23	9	9		1	1	1	1	1	1	2	1																										Expired	100%
24	9	9		1	1	1	1	1	1		1	1	1																								Expired	100%
25	10	10		1	2	1	1	1	1	1	1	1																									Admitted	100%
26	11	4		1	1	1	0	0	0	0	0	0	0	1																							Expired	36%
27	11	10	**	1	1	1	1	1	1	1	1	1	1	0																							Admitted	91%
28	12	11		1	1	0	1	1	1	1	1	1	1	1	1																						Admitted	92%
29	15	15		1	1	1	1	1	1	1	1	1				1	1	1	1	1	1																Admitted	100%
30	15	15		1	2	1	2	2	1	2	1		1	1		1																					Discharged	100%
31	15	15		1	2	1	1	1	1	1	1	1	1	1	1	1	1																				Admitted	100%
32	16	16		1	2		1	2	2	2	1	1	1	1		1	1																				Expired	100%
33	18	11	***	1	1	1	1	2		1	1	1	1	0	0	0	0	0	1	0								0	0								Admitted	61%
34	19	18	***	1	2	1	2	2	1	2	1	1	1	1	1	1		1	1																		Discharged	95%
35	19	19		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														Discharged	100%
36	20	19		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0														Expired	95%
37	20	19		2				1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1												Admitted	95%
38	23	23		1	2	1	1	2	1	2	1	1	1	1		1	1	1	1	1	1	1	1	1													Discharged	100%
39	30	29		1	2	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1			1	1	1	1	1		Discharged	97%
40	31	18		1	2	1	2	2			1	1	0	1	1	1	1	1	0	1	0	0	1	0	1	1	0	0	0	0	0		0	0			Discharged	58%
41	31	27		1	2	1	1	2	0	2	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0						Discharged	87%
42	34	30		1	2	1	1	2	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1		0	1	1	1	Admitted	88%
43	34	33		1	2	1	2	2	2				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Expired	97%
44	35	28		0	2	2	1	1	2	0	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1		1	1	1	1	1	1	1	1	1	Discharged	74%
45	35	32		1	2		1	2	2	2	0	1	0	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Admitted	91%
46	35	32		1	2	1	1	2	2	1	1	1	1	1	1	1	0	0		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	Admitted	91%
47	35	33	**	2	2	1	2	2	1	1	1	1	1	1	1	1		0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1		Discharged	94%
48	35	35		1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	Admitted	100%
49	36	1		0	2	00	0	0	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Admitted	3%
50	36	23		1	2	1	0	2	1	2	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	Admitted	64%

Figure 1 Legend	
2	2 tests in the same week period = 1 positive and 1 negative test
00	2 negative tests in the same week period
2	2 positive tests in the same week period
1	1 positive test in a week period
0	1 negative test in a week period
	Patient was transferred out of *C. auris* ward or discharged and was not tested during that week period
*	Developed *Candida auris* BSI during surveillance period (known to be colonized prior to start of surveillance period).
**	Developed *Candida auris* BSI prior to taking part in surveillance period (known to be colonized prior to BSI and prior to start of surveillance period).
***	Developed *Candida auris* BSI prior to taking part in surveillance period (not known to be colonized prior to BSI but was known to be colonized prior to start of surveillance period).

Figure 1. Persistence of *C. auris* colonization in a hospitalized cohort of patients. This figure shows the number of negative and positive screening tests per week; each block represents a week in each patient's separate timeline (weeks 1–33 on the top row). Gray blocks with a "1" inside represent a positive screening result and black blocks with a "0" inside represent a negative screening result. Blocks that are half gray and half black with a "2" inside represent a total of 2 tests for that week (1 positive test and 1 negative test result in the same week). Also, 2 zeros inside a black block "00" represent 2 negative results in the same week, and a number "2" inside a gray block represents 2 positive tests in the same week. Blocks with asterisks inside represent a *C. auris* bloodstream infection (see legend) and an empty gray block(s) represents a gap in testing due to the patient leaving the cohort unit where surveillance took place. The total number of tests and positive tests is also shown as well as disposition and positivity rates.

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Furthermore, some PACFs appear to be reservoirs for *C. auris* based on our admission screening. Resource limitations have been noted in prior studies among nursing home infection prevention and control (IPC) staff; for example, in one survey, 61% of respondents had no IPC training and 54% had at least 2 other responsibilities in addition to IPC.[10] In view of these findings, education on the use of enhanced-barrier precautions, placement in cohorts, and PPSs may be needed to prevent transmission of *C. auris* or other MDROs. PPSs should be used to detect unknown *C. auris* cases and not to continuously reassess known cases.[9] However, if rescreening of a colonized patient is being considered in an acute or postacute care setting, it should be done in consultation with public health agencies.

To our knowledge, this is the first report describing longitudinal trends of *C. auris* colonization among hospitalized patients. The limitations of this analysis include limited generalizability based on our single-center study design. Unlike other studies,[5] we did not perform fungal cultures on the screening specimens; thus, we were unable to address organism viability. Additionally, because patients were only tested while hospitalized, we were not able to determine the persistence of colonization outside the ACH setting. Finally, we were unable to control the time of sample collection; therefore, we were unable to determine whether it occurred before or after CHG bathing.

Our findings suggest that screening of patients for discharge, transfer, or to assess *C. auris* colonization clearance may not be warranted. As *C. auris* continues to spread,[11] known strategies to prevent transmission require implementation and research on methods to decolonize or decrease *C. auris* skin burden.

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Competing interests. None of the authors have any conflict of interests to report.

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