

The Antimicrobial Effectiveness of Chlorhexidine against a New Public Threat- *Candida auris*

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Purpose

Chlorhexidine (CHX) is a clinically proven broad-spectrum antimicrobial agent¹. With the rise of *Candida auris* as a multidrug resistant fungal pathogen², the present study was conducted to evaluate the effectiveness of Chlorhexidine against this pathogen by determining the Minimum Inhibitory and Minimum Bactericidal Concentrations (MIC/MBCs).

Methods

Minimum Inhibitory Concentration (MIC)

Two-fold dilutions of a CHX stock solution were prepared to produce a concentration range of 0.03-512µg/mL. Broth cultures of nineteen clinically isolated *Candida auris* strains were matched to a 5.0 McFarland Standard and diluted to 10⁵⁻⁶CFU/mL. Each Chlorhexidine dilution was mixed with inoculum and nutrient broth in micro titer plates, then incubated at 37°C for 18-24 hours before spectrophotometric analysis. Test controls were utilized to ensure proper microbial growth, sterility and complete solubilization of chlorhexidine.

Minimum Bactericidal Concentration (MBC)

Aliquots from each MIC well were grown for 24-48 hours on neutralizing agar plates at 37°C. Growth was confirmed via colony counting.

References

1. KS Lim and PCA Kam. Chlorhexidine – pharmacology and clinical applications. Anesthesia and Intensive Care, Vol. 36, No. 4, July 2008.
2. JF Meis and A Chowdhry. *Candida auris*: a global fungal public health threat. The Lancet Infectious Diseases. Vol. 18, issue 12, 1298-1299, Dec 2018.

Results

CHX MIC

Chlorhexidine inhibited all nineteen isolates of *Candida auris*. MIC concentrations ranged from 8-128µg/mL. Two isolates, CA-1097/23 and CA-1101/26, were the most susceptible with an MIC range of 8-16µg/mL. Six isolates, CA-0381/01, 0383/03, 0385/05, 0386/06, 1100/25, and 1102/27 had an MBC range of 16-32µg/mL. Almost half of the *Candida auris* strains, CA-0382/02, 0384/04, 0388/08, 0389/09, 0390/10, 0931/21, 1099/24, 1103/28, and 1104/29 were inhibited by 32-64µg/mL. CA-0387/07 and 1105/30 were the most tolerant with an MIC range of 64-128 µg/mL.

CHX MBC

All isolates were killed within 128µg/mL of Chlorhexidine. Eleven of the 19 isolates had the same MIC and MBC value. Six isolates, CA-0381/01, 0389/09, 0390/10, 0931/21, 1103/28 and 1101/26 had an increase in the MBC value over the higher end of the MIC range by 1-2-fold. One isolate, CA-1104/29, had a slightly lower MBC value than MIC (16-32 µg/mL compared to 32-64 µg/mL).

Minimum Inhibitory and Minimum Bactericidal Concentrations of Chlorhexidine for 19 clinical strains of *Candida auris*

Strain ID	MIC Value (µg/ml)	MBC Value (µg/ml)
0381/01	16-32	64-128
0382/02	32-64	32-64
0383/03	16-32	16-32
0384/04	32-64	32-64
0385/05	16-32	16-32
0386/06	16-32	16-32
0387/07	64-128	64-128
0388/08	32-64	32-64
0389/09	32-64	64-128
0390/10	32-64	64-128
0931/21	32-64	64-128
1097/23	8-16	8-16
1099/24	32-64	32-64
1100/25	16-32	16-32
1101/26	8-16	16-32
1102/27	16-32	16-32
1103/28	32-64	64-128
1104/29	32-64*	16-32
1105/30	64-128	64-128

*The MIC value was slightly higher than the MBC value.

Conclusions

Candida auris is emerging as a nosocomial multi-drug resistant pathogen of international concern. As new threats to healthcare continue to develop, technologies must meet the need of delivering lifesaving solutions. Although Chlorhexidine has been used for decades in a variety of clinical settings, its antimicrobial effectiveness continues to hold true.

The present study demonstrated that this broad-spectrum antiseptic agent is not only inhibitory, but cidal against the fungal pathogen, *Candida auris*.

Limitations & Disclosure

Study was conducted with sample size of 3 for each of the 19 strains so statistical analysis was not performed. Data on file at Teleflex. In vitro study may not be indicative of clinical performance.

Authors are employees of Teleflex, a manufacturer of medical devices with Chlorhexidine based antimicrobial technologies.

Future Directions

Further characterization of the effects of Chlorhexidine against *C. auris* will include determinization of the Kill Time and the Minimum Biofilm Eradication concentration.