Re-emergence of Mycobacterium chimaera in heater-cooler units despite an intensified cleaning and disinfection protocol

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Background:

Mycobacterium chimaera is an emerging pathogen associated with devastating infections of heart valve prostheses, vascular grafts, and disseminated infections after open heart surgery. Increasing evidence indicates airborne transmission resulting from aerosolization of M. chimaera from contaminated heater-cooler units (HCUs) used in cardiopulmonary bypass. Repeated detection of M. chimaera and other nontuberculous mycobacteria (NTM) in samples derived from HCUs prompted acquisition of brand-new HCUs (study HCUs) in our center in 2014 and implementation of an intensified cleaning and disinfection procedure from July 2014.

Material/methods:

Surveillance cultures consisting of HCU water samples and exhaust air samples were obtained approximately every 4 weeks. Since July 2014 study HCUs were serviced with an intensified cleaning and disinfection protocol while before HCUs were serviced according to manufacturer's recommendations. The protocol consisted of daily water changes with use of all-bacteria filtered tap water (Pall-Aquasafe Water Filter AQ14F1S; 0.2µm) and addition of hydrogen peroxide (100ml of 3% concentration) combined with a disinfection based on peracetic acid and hydrogen peroxide (Puristeril 340 Fresenius) every 2 weeks.

Results:

In our center a total of 5 HCUs was replaced in 2014 (2 in 01/14, 1 in 04/14, 2 in 09/14). Until July 2014 study HCUs tested negative for NTM.

To date, 101 water samples were taken from study HCUs, thereof 84 water samples after implementation of the intensified cleaning and disinfection protocol. Of all samples, 73 (72.2%) showed no mycobacterial growth, 6 (5.9%) were contaminated by bacterial overgrowth, and 22 (21.8%) yielded NTM: M. chimaera (12; 54.5% of all NTM), M. gordonae (9; 40.9%) and a combination of M. chimaera and M. gordonae (1; 4.5%). Sixty-nine out of 70 collected air samples remained
without mycobacterial growth. One (1.4%) grew *M. chelonae*, while no mycobacteria could be detected in the corresponding HCU water.

Microbial surveillance indicated growth of NTM after a median of 187 days (range 174 – 460 days) in water derived from HCUs. With regard to *M. chimaera*, 2 out of 5 HCUs remained without growth, whereas in 3 *M. chimaera* was detected after a median of 215 days (range 187 – 358 days).

**Conclusions:**

HCUs seem to provide favorable environmental conditions for the growth of preferably *M. chimaera* but also other NTM. An intensified cleaning and disinfection procedure does not suppress growth completely, but may attenuate growth and aerosolization. It remains unclear from this study design when the contamination happened. These findings emphasize the urgent need for a change in technology for temperature management during heart surgery to guarantee patient safety.

![Figure 1: results of HCU water surveillance cultures](image)

*y-axis displays results of mycobacterial cultures, 1 corresponds to detection of mycobacteria, 0 to no detection*