356

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HOW FREQUENTLY DOES HOSPITALIZATION OF PATIENTS COLONIZED WITH CARBAPENEMASE-PRODUCING *ENTEROBACTERIACEAE* (CPE) RESULT IN CONTAMINATION OF HOSPITAL SINK DRAINS?

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ABSTRACT

Background: There is growing evidence that hospital sinks and drains may be reservoirs for Gram-negative bacteria, which can be transmitted to patients. A report from Toronto implicating a sink drain in transmission of CPE to a hospitalized patient led us to systematically culture sinks after they were exposed to patients colonized with CPE.

Methods: At Mount Sinai Hospital (MSH), patients with risk factors for CPE are screened for colonization on admission with rectal swabs. Patients identified as colonized/infected with CPE are managed in private rooms with contact precautions and additional environmental disinfection. Beginning in 2013, we swabbed sink drains and overflows in rooms in which a patient with CPE had been present.

Results: From 10/2007-5/2016 18 patients colonized/infected with CPE have been identified at MSH (some with multiple strains/organisms); 16 were hospitalized including 1 who acquired CPE in hospital. There were 7 *Klebsiella* spp. (1 KPC, 1 OXA48, 1 NDM, 2 VIM, 2 OXA48+NDM); 6 *E. coli* (3 OXA48, 2 NDM, 1 KPC); 3 *E. cloacae* (1 KPC, 1 VIM, 1 NMC); and 4 other (1 KPC, 1 NDM, 1 VIM, 1 OXA24+OXA143). Since 2013, 14 hospitalized cases resulted in the exposure of 39 sinks to CPE. Swabs of five (12.8%) of these sinks, exposed to 3 different cases, yielded CPE after discharge cleaning [3 *E. coli* (2 KPC, 1 OXA48); 1 *E. cloacae* (KPC); and 1 *Klebsiella* spp. (VIM)]. In all cases, the organism and the enzyme from the sink matched that of the patient previously admitted to the room. The median room exposure was 9 days (range 2-76) for patients whose sinks became contaminated, and 5 days (range 1-81) for patients whose sinks were negative for CPE on discharge (P=0.56). Targeted cleaning of drains was not successful in removing CPE. In three cases, removal of the sink drain from outlet to wall resulted in subsequent cultures from the sink being negative. In one sink with an overflow, replacement of the sink was also required before negative cultures were achieved. Another sink with an overflow remained culture negative after steam cleaning.

Conclusions: In our hospital, 13% of sink drains were contaminated after exposure to CPE colonized patients. Procedures to protect hospital drains from CPE contamination are needed.

INTRODUCTION

There is growing evidence that hospital sinks and drains may be reservoirs for Gram-negative bacteria, which can be transmitted to patients [1-3]. The formation of biofilm in sink drains can protect bacteria from complete eradication with cleaning and disinfection (Image 1). Acting on a report from another Toronto facility implicating a sink drain in transmission of carbapenemase-producing *Enterobacteriaceae* (CPE) to a hospitalized patient, we began to systematically culture sink drains after they were exposed to patients colonized with CPE.

MANAGEMENT OF CPE POSITIVE PATIENTS

At Mount Sinai Hospital (MSH), patients with risk factors for CPE are screened on admission via rectal swab. Patients considered to be at risk for CPE are those who have had a previous hospital admission (within or outside of Canada), or who have travelled outside of North America and Northern Europe in the past two years.

CPE patient management:

- Private room with contact precautions
- Dedicated mobile medical equipment
- Patient transfers minimized (medically necessary only)
- Twice daily cleaning of high-touch surfaces in the room/bathroom
- Sporicidal gel cleaning twice daily for bathroom sink and toilet
- On discharge, room and bathroom are double cleaned (all surfaces wet x 10 mins.) and then closed to admissions pending results of sink drain swabs

SINK DRAIN CULTURE METHODS

- A cotton-tipped swab is inserted through the drain grate as deep as possible into the tailpiece, and the inside of the tailpiece scrubbed vigorously; several grate holes are used to ensure good coverage of the inner surface. If an overflow is present, a sample is also collected from the perimeter and inside of the hole with a second cotton-tipped swab.
- Swabs are incubated overnight in brain heart infusion broth at 37°C on a shaker. A sample of the broth is then plated to MacConkey CV agar 2mg/L cefpodoxime and incubated for 18-24 hours. Oxidase-negative Gram-negative bacilli are screened for reduced meropenem susceptibility by disc diffusion using a breakpoint of ≤25 mm. Non-susceptible isolates are worked-up for carbapenemase production as per lab protocol.

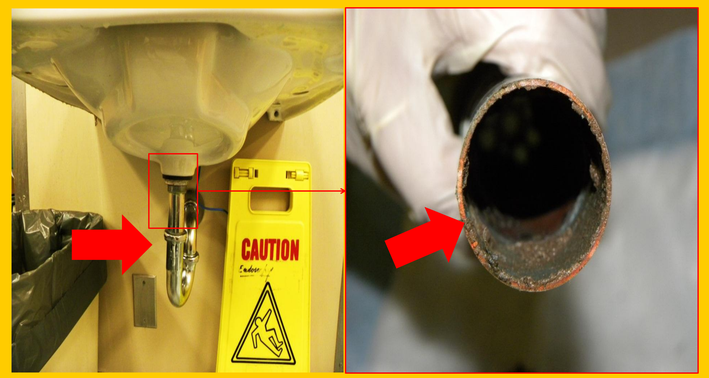

Image 1: Biofilm in tailpiece (right) from patient bathroom sink (left).

RESULTS

- From October 2007 to May 2016, 18 patients colonized/infected with CPE have been identified at MSH (some with multiple strains/organisms); 16 were hospitalized, including one who acquired CPE in hospital. There were 7 *Klebsiella* spp. (1 KPC, 1 OXA48, 1 NDM, 2 VIM, 2 OXA48+NDM); 6 *E. coli* (3 OXA48, 2 NDM, 1 KPC); 3 *E. cloacae* (1 KPC, 1 VIM, 1 NMC); and 4 other (1 KPC, 1 NDM, 1 VIM, 1 OXA24+OXA143; Figure 1).
- Since 2013, 39 sinks have been exposed to 14 hospitalized patients. Swabs of 5 (12.8%) of these sink drains, exposed to 3 different patients, yielded CPE after discharge cleaning [3 *E. coli* (2 KPC, 1 OXA48); 1 *E. cloacae* (KPC); and 1 *Klebsiella pneumoniae* (VIM)].
- In all cases, the organism and the enzyme from the sink matched that of the patient previously admitted to the room.
- We could not identify patient or sink factors associated with drain contamination, although the median room exposure was 9 days (range 2-76) for patients whose sinks became contaminated, and 5 days (range 1-81) for patients whose sinks were negative for CPE on discharge (P=0.56; Figure 2).

MANAGEMENT OF CPE POSITIVE DRAINS

- Soaking drains with undiluted 5% accelerated hydrogen peroxide was not successful in removing CPE.
- In 3 of 4 cases tested, removal of the sink drain from outlet to wall resulted in subsequent cultures from the sink drain being negative. In one sink with an overflow, replacement of the sink was also required before negative cultures were achieved.
- In a single case, a sink with an overflow remained culture negative after steam cleaning.

CONCLUSIONS

- We have documented repeated – although not common – contamination of sink drains in rooms exposed to patients colonized and/or infected with CPE; others have documented transmission from contaminated sinks to patients [1-3].
- Drains may become contaminated with CPE as a result of inappropriate use of handwashing sinks for patient care activities, disposal of body fluids in sinks, and/or rinsing of body fluid-contaminated receptacles in sinks. Even when hand hygiene sinks are used appropriately, drain contamination may occur.
- Appropriate facilities to dispose of body fluids should be provided for patients and staff.
- Procedures to protect hospital drains from CPE contamination, and patients from CPE-contaminated drains are urgently needed.
- The need for sinks in patient care areas should be weighed against the potential harm to patients of contaminated sinks.

REFERENCES

1. Clarivet B, Grau D, Jumas-Bilak E, et al. Persisting transmission of carbapenemase-producing *Klebsiella pneumoniae* due to an environmental reservoir in a university hospital, France, 2012 to 2014. Euro Surveill. 2016;21(17):pii=30213.
2. Kotsanas D, Wijesooriya WR, Korman TM, et al. "Down the drain": carbapenem-resistant bacteria in intensive care unit patients and handwashing sinks. Med J Australia 2013;198:267-9.
3. Lowe C, Willey B, O'Shaughnessy A, et al. Outbreak of extended-spectrum beta-lactamase-producing *Klebsiella oxytoca* infections associated with contaminated handwashing sinks. Emerg Infect Dis 2012;18:1242-7.

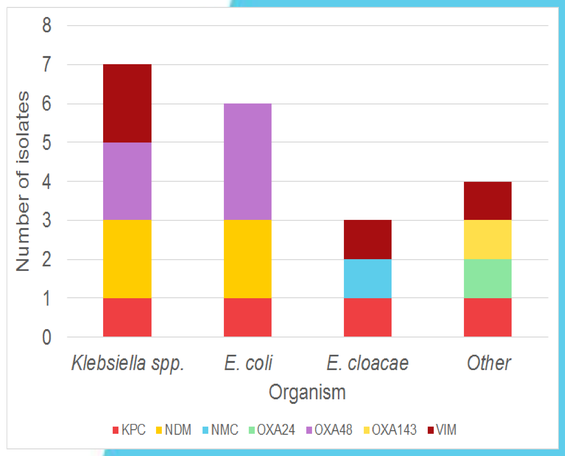

Figure 1: Carbapenemase genes isolated by organism at MSH since 2007.

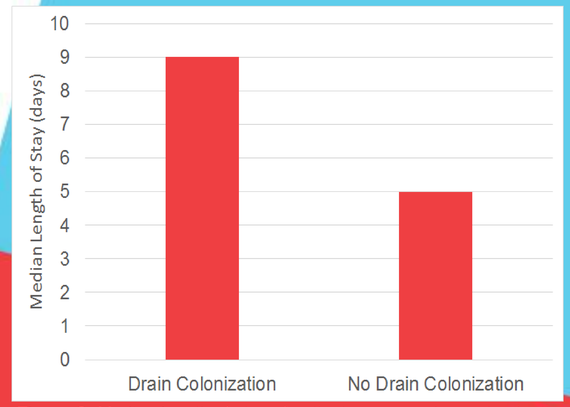

Figure 2: Median length of stay of patients in rooms by contamination status of drain (p=0.56).