Hospital Privacy Curtains – What's hanging around?

By Kendyl Carikas and Shona Matthews

Abstract Pathogens survive in the patient environment, including privacy curtains, for a significant period of time and pose a risk of disease transmission. Disposable antimicrobial, sporicidal privacy curtains offer an infection prevention strategy in combating the transmission of multi-drug-resistance organisms between patients

Keywords Pathogen transmission, patient environment, privacy curtains, sporicidal, antimicrobial, infection control.

Introduction

The patient environment can harbour potential pathogens making it a possible source for cross-transmission to the hands of healthcare workers, patients and their visitors (Cheng *et al.*, 2015).

Some of the most common hospital-acquired pathogens survive on dry surfaces, such as privacy curtains, for many months. A literature review by Kramer, Schwebke & Kampf showed that most gram-positive bacteria such as Vancomycin Resistant Enterococcus (VRE), *Staphylococcus aureus,* including Methicillin resistant *Staphylococcus aureus* (MRSA), and *Streptococcus pyogenes* survive for months on dry surfaces, as do many gram-negative species such as *Escherichia coli*, and *Pseudomonas aeruginosa*.

Mycobacteria including *Mycobacterium tuberculosis* and spore forming bacteria including *Clostridium difficile* can also survive for months as can fungal pathogens like *Candida albicans*.

Most viruses from the respiratory tract such as *coxsackie* and *influenza* can persist on surfaces for only a few days but those from the gastrointestinal tract, such as rota virus, and *astrovirus* persist for up to two months (Kramer, Schwebke & Kampf 2006).

Non-sanitised fabric surfaces are potentially a continuous source of pathogen transmission and come into ready contact with healthcare workers, patients, and visitors, therefore posing a risk of cross-contamination.

The Research

A research study by Mody and Gibson (2019) from the University of Michigan looked at the pathogen loading of patient privacy curtains, presenting their findings at the European Congress of Clinical Microbiology and Infectious Diseases in April this year. The study aimed to better inform curtain hygiene protocols.

The prospective cohort study across six skilled nursing facilities, or rehabilitation rooms, obtained bacterial culture samples from several sites on each patient's body as well as from 'high–touch' surfaces in the patient's room. Samples were taken upon admission, after 14 days, 30 days and then monthly up to six months. A total 1521 samples from 625 rooms were obtained from the edge of privacy curtains where they are touched most often.

The study found that 22 per cent of cultures taken from privacy curtains tested positive for multi-drug resistant organisms (MDROs) with contamination rates varying from 11.9 to 28.5 per cent across the different facilities. Of these cultures, 13.8 per cent were contaminated with VRE; 6.2 per cent with resistant gram-negative bacilli (R-GNB); and 4.9 percent with MRSA.

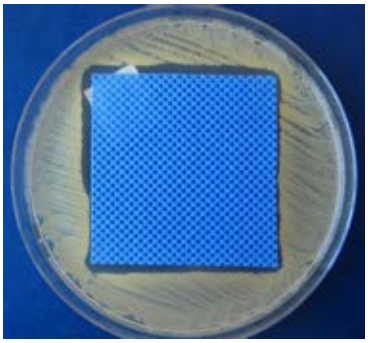
In 15.7 per cent of cases, patients and their privacy curtain were concurrently colonised with the same multi drug-resistant organism (MDRO).

Ohl, Schweizer, Graham, Heilmann, Boyken and Diekema (2012) from the University of Iowa conducted a longitudinal study to determine the prevalence and time course of bacterial contamination on privacy curtains after laundering. Over a three-week period, swab cultures were obtained twice weekly from the leading edge of 43 curtains in 30 rooms in two intensive care units and a medical ward. Contamination with *Staphylococcus aureus,* MRSA, Enterococcus, VRE or aerobic gram-negative rods was determined.

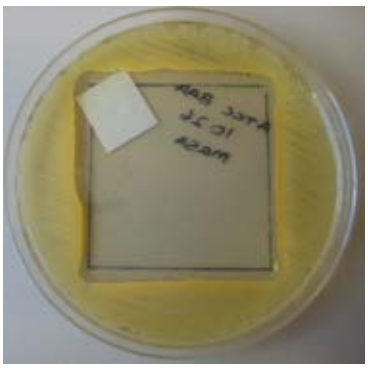
Ninety-two percent of curtains placed during the study showed contamination within one week; 95 per cent demonstrated

Images from 24 month testing for Antimicrobial and Sporicidal curtain (Endurocide)

Methicillin-Resistant *Staphylococcus aureus* (Zone of inhibition)



Methicillin-Resistant *Staphylococcus aureus* (Contact inhibition)



Images courtesy of Despina Kotsanas.

contamination on at least one occasion, including 21 per cent with MRSA and 42 per cent with VRE. Eight curtains yielded VRE at multiple time points, suggesting frequent recontamination.

The study concluded that privacy curtains are rapidly contaminated with potentially pathogenic bacteria and interventions are required to reduce curtain contamination. The immediate implication of this study showing substantial bacterial contamination of privacy curtains is that healthcare workers should complete hand hygiene after touching curtains and before touching the patient.

Mahida, Beal, Trigg, Vaughan and Boswell (2014) described the investigation and control of an outbreak of group A *Streptococcus* (GAS) infection in an ear nose and throat ward which revealed 10 out of 24 fabric curtains were contaminated with the same strain. This was the first outbreak report to demonstrate patient curtains as the potential source for GAS cross-transmission, with implications in relation to hand hygiene and the frequency of curtain laundering.

Hand hygiene and targeting privacy curtains for disinfection

While nurses and medical staff understand the importance of hand hygiene in preventing the spread of infection, achieving full compliance still remains a challenge. Patients and visitors generally have a lower level of awareness and curtains in reality come into contact with staff, patients and visitors alike.

Disposable privacy curtains have been marketed over the past few years as a passive infection prevention strategy. Most brands claim some form of anti-microbial activity. This may be due to the polypropylene surfaces that inhibit pathogen growth or to various anti-bacterial technologies employed.

Monash Health in Australia tested silver-impregnated curtains hung in the intensive care unit in 2014 and found these to have excellent antimicrobial and sporicidal activity for up to six months (Kotsanas, Wijesooriya, Sloane, Stuart,& Gillespie, 2012). Recent reformulations have extended one antimicrobial and sporicidal product (Endurocide Aberdeenshire, Scotland) curtain life up to two years and this was tested in a subsequent study by the Monash team (Kotsanas & Gillespie 2016).

Effectiveness of antimicrobial sporicidal curtains

Kotsanas and Gillespie (2016) tested the zone of inhibition and contact inhibition against a range of microorganisms including gram negative: extended-spectrumβlactamase *Escherichia coli, Stenotrophomonas maltophilia,* carbapenemase-producing *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*; and gram positive: methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus faecium,* and coagulase-negative staphylococci), *Candida albicans*, and spores *of Clostridium difficile*. Excellent results were achieved for both the zone of inhibition and contact inhibition when tested at baseline, six, 12, 18, and 24 months with no visible loss of activity.

The curtains are composed of extruded 0.5 mm thick polypropylene. They are impregnated with a blend of quaternary ammonium chlorides and repellent negatively charged silicone as well as being fire retardant. The biostatic and biocidal properties also prevent bacteria from penetrating or multiplying on the curtain.

Kotsanas and Gillespie (2016) also conducted a cost benefit analysis for replacing standard fabric curtains with the newer formulation (Endurocide) sporicidal and antimicrobial curtains. When the cost of laundering, hanging and removing fabric curtains on a regular three month cycle is considered, there is a significant cost saving involved in using the Endurocide curtain with a two year life.

The Monash 2016 study concluded that the curtains provide sporicidal and antimicrobial protection to all patients, staff and visitors accessing

the patient area as well as endorsing and promoting the implementation of the new formulation Endurocide privacy curtains from both a cost-effectiveness and safety perspective (Kotsanas & Gillespie, 2016).

Antibiotic Resistance

The patented sporicide used on the brand of curtains in this trial contains an active ingredient that attacks the cell wall and kills the pathogen. This is not a mode of action a pathogen can become resistant to and is completely different to that of carbapenem antibiotics. The sporicide is also electrostatically bonded to the surface of the fabric. This creates static that grabs hold of the pathogen so it cannot be released and passed on. The sporicide then quickly kills it (Endurocide, 2018).

Recycling of sporicidal disposable curtains

As of 2019 New Zealand has an onshore recycle option where the curtains are melted, pelletised and the plastic pellets re-sold to be made into other plastic products. Curtain recycling is organised through existing hospital waste channels. This means that affording patients a less infected environment by means of sporicidal disposable curtains is a sustainable option.

Conclusion

There is a growing recognition that the hospital environment is strongly implicated in the transmission of healthcare-related infections. Privacy curtains that separate patient care areas in most hospitals are a potentially important site of contamination given the frequency that they are touched by patients, visitors and hospital staff. Strategies to inhibit curtain contamination and potential transfer of bacteria from curtains to patients on a continuous basis is required. The use of disposable antimicrobial and sporicidal privacy curtains offers a tool in combating the transmission of MDRO.

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