ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 4, Issue 2, pp: (26-30), Month: April - June 2016, Available at: www.researchpublish.com

Isolation of Pathogenic Bacteria from Fomites in a Clinical Laboratory Science Teaching Lab

Kerene Walker[1], Jermaine Walters[2], Shellon Solomon[3], Thonishae Coley[4]

Department of Medical Technology, Northern Caribbean University, Manchester, Jamaica, WI

Abstract: **Due to the nature of the work there, transfer of pathogens from fomites can easily occur in a clinical laboratory science teaching lab and cause infectious diseases in lab users and other persons with whom they interact.**

Purpose: To determine whether solid surfaces in a clinical laboratory science teaching lab act as fomites, what microbes are harbored by them, and explore the significance of the findings.

Method: The study employing an experimental design was conducted at a university in central Jamaica, WI. Six solid surfaces including door handles, work station counter tops, hand wash sink faucet, student's lab coat sleeve, and the seat of a wooden lab stool were swabbed and cultured onto MacConkey, blood and chocolate agar media.

Results: Gram negative bacteria were recovered from all sites except for the work station counter top which showed no growth. Microbes recovered in descending order of occurrence were *Pantoea agglomerans, Serratia rubidaea, Enterobacter aerogenes and Escherichia coli.*

Conclusion: Solid surfaces in a clinical laboratory science teaching lab act as fomites although not all microbes are clinically significant to immunocompetent persons.

Keywords: **Fomites, teaching lab, infection control, pathogens, Pantoea agglomerans, Serratia rubidaea, Enterobacter aerogenes, Escherichia coli.**

I. INTRODUCTION

A fomite is any inanimate object that may be contaminated with infectious organisms and serve in their transmission from one person to another, like doorknobs, sink taps, cutting board and computer keyboards.[1] Due to the nature of the work there, transfer of pathogens from fomites can easily occur in a clinical laboratory science teaching lab. Body fluids such as blood, urine, stool and sputum that are potentially infectious and live cultures of infectious agents are examined and processed by students and faculty in a teaching lab. Although universal safety precautions, particularly in relation to hand hygiene, are taught to students and routinely practiced by most lab users, the possibility that persons at times ignore these precautions when entering or exiting the lab, and touching and decontaminating laboratory solid surfaces does exist. These may result diseases ranging from respiratory, enteric, skin and wound infections[2,3]. Several microorganisms can survive on fomites for time long enough to be transmitted to hands or other exposed areas of the body. Among these are *Enterococcus faecalis* and *Enterococcus faecium* which can survive on fomites for up to seven days[4,5,6,7]. Because clinical laboratory students and faculty interact with persons, family and friends, who are not lab practitioners, the risk of transmitting potentially infectious microbes to these persons, just by routine daily activities, cannot be overlooked.

Research questions:

1. Do solid surfaces in a clinical laboratory science teaching lab act as fomites?
2. What microbes are harbored on these fomites?
3. How significant are these microbes?

ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 4, Issue 2, pp: (26-30), Month: April - June 2016, Available at: www.researchpublish.com

Hypothesis: Clinically significant bacteria can be found on fomites in clinical laboratory science teaching labs.

Significance of study: In a clinical laboratory science teaching lab, medical technologists are trained to practice universal safety precautions for infection prevention and control. While they studiously follow these when directly handling body fluids, at times they overlook simple aseptic techniques regarding handling of sinks, counter-tops and other solid surfaces in the lab. This could result in infections of students and workers and other persons with whom they interact. Therefore, this research aims to determine whether there are microbes on fomites in a teaching lab and explore implications for the findings.

II. METHODOLOGY

Sample:

The research was conducted as an experimental design at a university in central Jamaica, WI. Five surfaces in the clinical laboratory science teaching lab were included in this study. They were the door handles used to enter and exit the lab, a handwashing sink faucet, a work station counter top, a wooden stool seat and a student's lab coat sleeve.

Procedure:

1. Each surface was swabbed with a sterile H_2O moistened cotton swab, and each swab placed into peptone water and incubated at 35 °C for 24 hours[8].

2. After 24 hours, the swabs were inoculated unto one MacConkey, one blood, and one chocolate agar plate each (1 sample for each set) and incubated at 35 °C for 24 hours in ambient air or CO_2 as required[8].

3. Isolates were then identified using Gram's staining, catalase, oxidase, and short-line biochemical tests for Gram negative bacilli[8].

III. RESULTS

TABLE I Microbes recovered from fomites

Lab surface	Microbe(s) recovered
Exit door handle	*Pantoea agglomerans*
Entry door handle	*Pantoea agglomerans*
Sink faucet	*Escherichia coli, Pantoea agglomerans*
Wooden stool	*Serratia rubidaea*
Lab coat sleeve	*Enterobacter aerogenes, Pantoea agglomerans*
Work station counter top	None

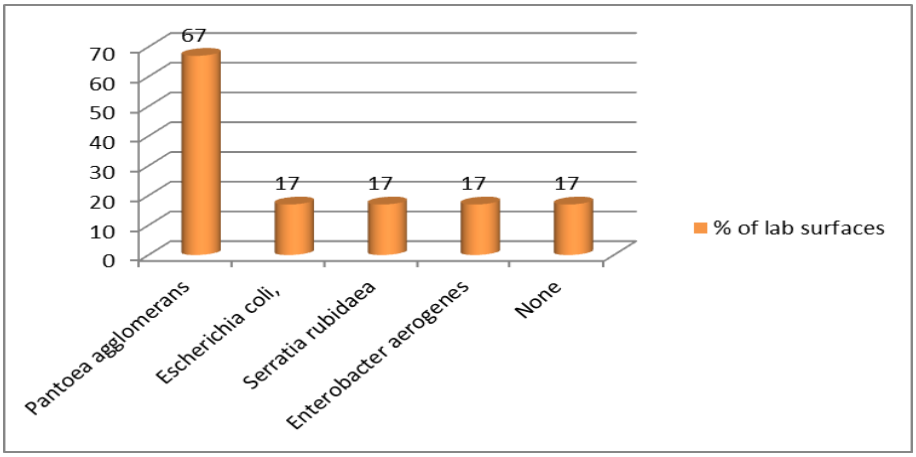

Fig. 1 Frequency of microbes on fomites (%)

The Gram negative bacilli *Escherichia coli* and *Pantoea agglomerans* were isolated from the sink faucet; *Enterobacter aerogenes* and *Pantoea agglomerans* were isolated from the lab coat sleeve; *Pantoea agglomerans* was isolated from the entry and exit door handles, and *Serratia rubiaea* was isolated from the wooden stool seat.

IV. DISCUSSION

As shown in table 1 and figure 1 above, *Pantoea agglomerans* (formerly *Enterobacter agglomerans*) was the most frequently recovered species of bacteria. It is a Gram negative aerobic bacillus in the family Enterobacteriaceae. *P. agglomerans* is normally not pathogenic in healthy humans, humans but in instances where the host is immuno-compromised such as in nosocomial infections, or tears in the skin, *P. agglomerans* may cause infections[9]. All species of the genus Pantoea can be isolated from feculent material, plants, and soil, where they occur either as pathogens or commensals. One must note that the fomites from which this species of bacteria was recovered, door handles, faucet, and lab coat sleeve, are all areas which are exposed to the natural habitat of the Pantoea species which is plants. In fact, students and workers may routinely have handled materials containing the microbe then touched the laboratory surfaces without realizing that they were transferring microbes.

Although not normally pathogenic in healthy humans and so should be harmless to the clinical laboratory sicence students and faculty, it can prove to be significant because, as in this study, within the genus, *P. agglomerans* is the most commonly isolated species in humans, often from soft tissue or bone/joint infections following penetrating trauma by vegetation[9]. *P. agglomerans* bacteremia has also been described in association with the contamination of intravenous fluid, total parenteral nutrition, the anesthetic agent Propofol, and blood products[9]. However, spontaneously occurring bacteremia has rarely been reported, and the role of *P. agglomerans* as a pathogen in other circumstances is unclear.

Enterobacter aerogenes was isolated from a student's lab coat sleeve. Like *P. agglomerans*, Enterobacter species rarely cause disease in healthy individuals[10] and should not affect the students and faculty of the clinical laboratory science programme. However, among immunocompromised persons, Enterobacter species, particularly *Enterobacter aerogenes* and *Enterobacter cloacae*, are important nosocomial pathogens responsible for various infections, including bacteremia, lower respiratory tract infections, skin and soft-tissue infections, urinary tract infections (UTIs), endocarditis, intra-abdominal infections, septic arthritis, osteomyelitis, and ophthalmic infections[10]. Enterobacter species can also cause various community-acquired infections, including UTIs, skin and soft-tissue infections, and wound infections, among others. This opportunistic pathogen, similar to other members of the Enterobacteriaceae family, possesses an endotoxin known to play a major role in the pathophysiology of sepsis and its complications[10].

Serratia rubidaea was isolated from the seat of the wooden lab stool. Like the previously mentioned bacteria, it does not usually cause infections[11] in healthy humans and so should not pose a threat to students and faculty of the clinical laboratory science programme who use the teaching lab. It occurs as a gram negative, straight bacillus, interesting in the fact that it sometimes produces the red pigment prodigiosin[11]. While clinically, *S. rubidaea* is rarely seen as an infection in healthy humans, some opportunistic infections have been documented in humans with compromised immune systems. In these instances the organism can cause bacteremia, respiratory tract infections, UTI's, eye infections, and wound infections[11]. Nosocomial infections are more commonly documented than community acquired infections[11].

Escherichia coli was recovered from the hand wash sink faucet. It is a Gram negative facultative anaerobic bacillus from the Enterobacteriaceae family, inhabiting the intestines of humans and animals[12]. Most *E. coli* are harmless and are an important part of the healthy human intestinal tract where they aid in the digestive process. However, some *E. coli* are pathogenic when they are transferred to areas outside the intestinal tract and cause infectious diseases ranging from diarrheal diseases to urinary tract infections[12]. Pathogenic types of *E. coli* can be transmitted through contaminated water or food, or through contact with animals or humans. Pathogenic *E. coli* strains are categorized into pathotypes. Six pathotypes are associated with diarrhea and collectively are referred to as diarrheagenic *E. coli*, that is not always pathogenic to humans[12].

- Shiga toxin-producing *E. coli* (STEC)—STEC may also be referred to as Verocytotoxin-producing *E. coli* (VTEC) or enterohemorrhagic *E. coli* (EHEC). This pathotype is associated with foodborne outbreaks.
- Enterotoxigenic *E. coli* (ETEC)
- Enteropathogenic *E. coli* (EPEC)

- Enteroaggregative *E. coli* (EAEC)
- Enteroinvasive *E. coli* (EIEC)
- Diffusely adherent *E. coli* (DAEC)

The *E. coli* species recovered from the faucet was not typed. However, the preceding discussion should make users of the clinical laboratory science lab more sensitive to the need always to follow universal safety precautions when removing gloves, washing up laboratory instruments, and handling samples that potentially contain *E. coli* and decontaminating even the faucet before and after use.

The fact that no microbes were recovered from the work station counter top in the lab was expected. Counters are routinely and studiously cleaned by lab users before and after use, because they are conscious of the potential risks if that were not done. Nonetheless, if the same amount of care that is taken to clean the work stations were exercised in ensuring that other lab surfaces are decontaminated, the risk of transmission of infections by fomites could be reduced further still.

V. CONCLUSION

The purpose of this research was to determine whether solid surfaces in a clinical laboratory science teaching lab act as fomites, what microbes are harbored by them, and explore the significance of the findings. In doing so, the hypothesis was proven to be true and will be retained. The four bacteria recovered - *P. agglomerans* , *Enterobacter aerogenes* , *Serratia rubidaea* , and *E. coli* – proves the hypothesis. However, the recovery of the former three bacteria should be taken without great alarm because usually, they are not pathogenic to healthy humans. Rather, immunocompromised persons are at greater risk of infections and harmful effects. The presence of *E. coli* should be taken with more caution as this microbe has the potential to cause serious and devastating diseases in humans. It is noteworthy that no microbes were recovered from the work station counter tops in the lab. This is testament of the decontamination and infection control measures practiced by users. However, it also highlights the need for greater care to be placed on ensuring that all lab surfaces are routinely and appropriately decontaminated and standards of universal safety precautions are reinforced and maintained.

REFERENCES

[1] Maier RM, Pepper IL,Gerba CP. Environmental microbiology [Internet]. 2nd ed. Burlington (MA): Elsevier; 2009. Available from: http://books.google.com.jm/books?id=A2zL8YBXQfoC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

[2] Pyrek KM. Fomites' Role in Disease Transmission is Still Up for Debate. Infection Control Today.2002 August 1. Available from http://www.infectioncontroltoday.com/articles/2002/08/fomites-role-in-disease-transmission-is-still-up.aspx

[3] Boone SA. Gerba CP. Significance of Fomites in the Spread of Respiratory and Enteric Viral Disease. Applied and Environmental Microbiology [Internet]. 2007 March; 73(6): 1687-1696. Available from: http://aem.asm.org/

[4] Bennett JV, Jarvis WR, Brachman PS. Bennett &Brachman's hospital infections [Internet]. 5th ed. Philadelphia (PA): Lippincott Williams and Wilkins; 2007 Available from: http://books.google.com.jm/books?id=tuy4zw5G4v4C&pg=PA277&dq=research+done+on+infection+transmitted+by+fomites&hl=en&ei=Yc9-TdXwGqu90QHis9z9CA&sa=X&oi=book_result&ct=result&resnum=4&ved=0CD0Q6AEwAw#v=onepage&q&f=false

[5] Fomites and Infection Transmission. Infection Control Today. 2006 November 7. Available from http://www.infectioncontroltoday.com/articles/2006/11/fomites-and-infection-transmission.aspx

[6] Kurkjian KM, Little SE. Routes of transmission of infectious diseases agents. The University of Georgia College of Veterinary Medicine 2003. Available from:http://www.vet.uga.edu/vpp/archives/IVM/ENG/Modes/routes.htm

[7] HurstCJ. Modeling disease transmission and its prevention by disinfection. New York (NY): Cambridge University Press; 1996. Available from: http://books.google.com.jm/books?id=eLKMCkpnr8C&pg=PA11&lpg=PA11&dq=infectious+agents+that+can+be+spread+by+fomites&source=bl&ots=Csflhhhliz&sig=mEc1mOFtoLRR8UVyzYR1K84L0&hl=en&ei=87N_TcCGKJCP0QHn8vX5CA&sa=X&oi=book_result&ct=result&resnum=4&ved=0CCIQ6AEwAw#v=onepage&q=infectious%20agents%20that%20can%20be%20spread%20by%20fomites&f=false

[8] Stukus PE. Investigating Microbiology: A laboratory manual for general microbiology. Saunders College publishing; 1997

[9] Cruz AT, Cazacu AC, Allen CH. Pantoea agglomerans: a Plant Pathogen Causing Human Disease. Journal of Clinical Microbiology. June 2007. 45:6; 1989-1992. doi: 10.1128/JCM.00632-07.

[10] Public Health Agency of Canada. 2010. Enterobacter pathogen safety data sheet- infectious substances. Available from http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/enterobacter-eng.php

[11] Ursua PR, Unzaga MJ, Melero P, Iturburu A, Ezpeleta C, Cisterna R. *Serratia rubidaea* as an Invasive Pathogen. Journal of Clinical Microbiology. Jan 1996. 34:1; 2016-2017. Available from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC228767/

[12] Centers for Disease Control and Prevention. *Escherichia coli* fact sheet. 2015. Available from http://www.cdc.gov/ecoli/general/index.html.