ORIGINAL ARTICLE

Lurking Threat of Endowasher Contamination – A Cause for Post-endoscopic Infections

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ABSTRACT

Aim: *Endowashers are the main source of infection in endoscopy. Therefore, we undertook this study to evaluate endowashers as a source of infection after endoscopic procedures.*

Methods: *A total of 240 endowashers were sampled. Sterile water was made to flow through the pump of the endowasher and the water samples were collected and tested microbiologically according to standardized tests. If endowashers were contaminated, the devices were reprocessed and re-examined.*

Results: *Of 240 samples, 160 (66.7%) were contaminated with pathogens of up to > 20 000 CFU/mL.* Pseudomonas aeruginosa *and other Gram-negative non-fermenters such as* Stenotrophomonas *spp and* Acinetobacter *spp, and* Staphylococcus aureus *among Gram-positive organisms were more predominant. Some of the Gram-negative bacilli, such as* Enterobacter cloacae *and* Serratia *spp were also isolated. Both* Streptococcus *spp and* Candida albicans *were the least common organisms isolated from the endowasher water samples.*

Conclusion: *Endowashers can be a potential source of infection. Hence, routine checking of the water samples for quality control of endowashers should be done to monitor the spread of nosocomial infections by potentially resistant bacteria.*

Keywords: Disinfection, endoscopy, endowasher, quality control, reprocessed, samples

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INTRODUCTION

Endoscopy is one of the most frequently used procedures for diagnosing various diseases and for therapeutic procedures (1, 2). Endoscopes have become a source for the transmission of nosocomial infections compared to other medical devices (2). Post-endoscopy infections should be prevented because of the serious complications involved (3). Professional bodies and health agencies worldwide have provided various recommendations about the need for frequent sampling in order to check for microbial contamination along with reprocessing of the endoscopes to monitor the spread of infections and for the safety of the patients (4, 5). An endowasher (Endo Technik, Solingen, Germany) is a pump-like instrument which can dispense water stored in a bottle with the aid of a rubber tube into endoscopes for cleaning during the procedure. A large quantity of water is dispensed within a short duration into the endoscopes using the endowasher, which is similar to an irrigation pump. The main purpose of using the endowasher is to present an improved vision by cleaning the bowel of residual faeces, and blood and mucus during endoscopic procedures in the abdomen (1). The usage of endowashers has become very common and they are used in a wide range of procedures. However, endowashers, which are not included in microbiological surveillance, have become a source for the spread of cross-infections and nosocomial infections (6). Therefore, endowashers must be part of the quality control process to prevent infections (7).

Official bodies that have published recommendations have not mentioned the risk of endowasher contamination as a cause of infection. These official bodies include the United States Food and Drug Administration [US FDA] (8), Association for Professionals in Infection Control and Epidemiology [APIC] (9), European Society of Gastrointestinal Endoscopy [ESGE] (7, 10) and the American Society for Gastrointestinal Endoscopy [ASGE] (11).

Undetected defects are the primary cause of infection in endoscopic procedures, hence regular monitoring is essential to avoid such nosocomial infection spread (12). The Robert Koch Institute (RKI), a professional body which

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governs the cleaning and disinfection of endowashers, published a recommendation on the hygiene required for endoscopes (13). Endowashers need additional instruments and should be processed according to RKI recommendations and rules to cleanse and monitor for infection.

The aim of this study was to investigate endowashers acting as a source of nosocomial infection, especially if the patient had undergone endoscopic procedures.

MATERIALS AND METHOD

A total of 240 endowashers were sampled. The study was carried out at the Endoscopy Center, Xinxiang Central Hospital, China, during the period January–December 2013. The study was approved by the Institutional Ethics Committee. Sterile water was pumped into the endowashers and tested microbiologically according to standardized tests.

The endowashers were reprocessed and re-tested if found contaminated. The source of contamination in endowashers can be due to the rubber tube and/or the water bottles. Using RKI guidelines (13), only the water from the bottles – which act as a reservoir – was included in the microbiological surveillance (4, 5).

To ascertain the source of infection in endowashers, the samples taken from pumps and rubber tubes were assessed according to the method used by the Chinese Society of Gastroenterology (14). Two samples were collected, one before disinfection and another one after disinfection of the endowashers. Fifty millilitres of the sterile water was made to flow through the tubes of the endowashers and then they were collected to test for the presence of any micro-organisms; 0.5 mL and 0.1 mL of the aliquots were spread on trypticase blood agar (5% sheep blood; Oxoid, Germany) using L rod, then membrane filters 0.45 µm pore size (Sartorius, Germany) were used to separate out the remaining samples. After filtration, the membranes were removed carefully and put on the trypticase blood agar. The plates were kept in incubation at 37 °C for 24 to 48 hours. After incubation, the colonies were identified based on the morphology and biochemical characters (15).

After initial sampling from the endowashers, the presence of growth of any micro-organisms signified contamination. If the endowashers were positive for bacterial growth, infection control was done by either changing the tubes and water, or by dispensing the chemical disinfectant through the rubber tubes according to guidelines. After thorough rinsing of the endowashers with disinfectant, sterile water was made to pass through to remove traces of disinfectant present and again one sample was collected which served as a control. If repeated growth was seen, the endowashers were cleansed with disinfectant again and checked for the presence of growth of any micro-organisms. If there was growth even after the second disinfection, the endowashers were disposed of as they were not disinfectable and new endowashers were used for the procedures.

Statistical analysis was done for mean and standard deviation of the number of pathogens in the groups. A *p*-value of < 0.05 was considered as statistically significant.

RESULTS

Of 240 samples collected from endowashers, 160 (66.7%) were contaminated with pathogens of up to > 20 000 CFU/mL (Figure). Out of 240 samples collected, 80 (33.3%) showed no growth (40 samples were from the first control and 40 from the second control samples); 14/40 (35%) control samples indicated no growth in the first, followed by 32/40 (80%) which indicated no growth in the second control samples (Table 1). Five endowashers were disposed since complete disinfection was not attained.

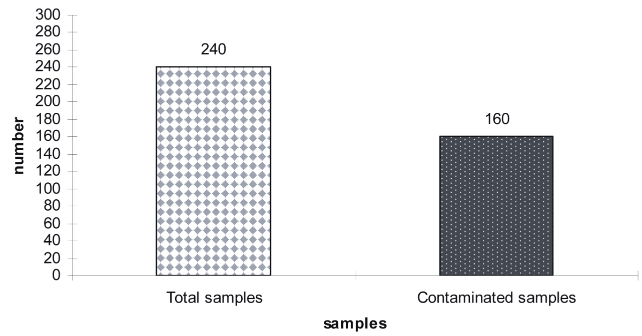

Figure: Distribution of the total and contaminated samples collected from endowashers.

Table 1: Distribution of the samples with and without growth from initial, 1st and 2nd control samples

	No. (%) of samples		
Sample	**Growth**	**No growth**	**Total**
Initial sample	160 (66.7)	80 (33.3)	240
1st control sample	26 (65)	14 (35)	40
2nd control sample	8 (20)	32 (80)	40

Out of 160 samples tested for the presence of micro-organisms, 92 (57.5%) were identified as *Pseudomonas aeruginosa,* 10 (6.3%) were identified as *Stenotrophomonas* spp and three (1.8%) as *Acinetobacter* spp; *Staphylococcus aureus* was found in 23 (14.4%) samples. *Enterobacter cloacae* were identified in 18 (11.3%), *Candida albicans* in nine (5.6%), *Serratia* spp in four (2.5%) samples and *Streptococcus* spp in only one (0.6%) sample (Table 2).

After the first disinfection, 40 water samples were collected again and tested for the presence of microbiological contamination: 26/40 (65%) showed the presence of growth, of which 18 (69.2%) grew *Pseudomonas aeruginosa,* six (23.1%) were identified as *Staphylococcus aureus* and two (7.7%) were *Enterobacter cloacae* (Table 3). In the second control sampling, only eight (20%) showed the presence of

Table 2: Distribution of various micro-organisms isolated from endowasher samples

Organisms isolated	n (%)
Pseudomonas aeruginosa	92 (57.5)
Stenotrophomonas spp	10 (6.3)
Acinetobacter spp	3 (1.8)
Staphylococcus aureus	23 (14.4)
Enterobacter cloacae	18 (11.3)
Candida albicans	9 (5.6)
Serratia spp	4 (2.5)
Streptococcus spp	1 (0.6)

Table 3: Organisms isolated in first and second control sample

Microorganism isolated	n (%)
1st control sample (n = 26)	
Pseudomonas aeruginosa	18 (69.2%)
Staphylococcus aureus	6 (23.1%)
Enterobacter cloacae	2 (7.7%)
2nd control sample (n = 8)	
Pseudomonas aeruginosa	6 (75%)
Enterobacter cloacae	2 (25%)

growth of bacteria: six (75%) were found to be *P aeruginosa* and two (25%) were *Enterobacter cloacae* (Table 3). No statistically significant difference was found between the number of organisms isolated and number of samples.

DISCUSSION

The aim of this study was to investigate post-endoscopic infections caused by endowashers by assessing the water samples using microbiological analyses. A total of 66.7% of the water samples collected showed heavy growth, which is less compared to Hubner *et al* (14) who reported 79% of samples with up to > 20 000 CFU/mL of micro-organisms from endowashers. No statistical significance was found between the organisms isolated and numbers of samples collected.

Lack of infection control guidelines for endowashers impedes monitoring of hygiene in endoscopic procedures (16). Another setback is that endowashers are not included in most of the guidelines used for endoscopy (17). Hence, the infection risk involved from the water, which is highly contaminated during the procedures, must be monitored by including endowashers in the recommendations and various guidelines such as APIC, RKI and those adopted by the Chinese Society of Gastroenterology (11, 13, 14), which recommend the sterility of water used in endoscopic procedures. The European Society of Gastrointestinal Endoscopy has no recommendation on the sterility of the water but mentions the bottles used in the endowashers as sources of infections and recommends that they be autoclaved before the procedures (7). Water that is used for optical lens cleaning is sterile and standard; likewise, there should be some implication in the guidelines for the use of water in the endowashers to match the standard sterility.

Rutala and Weber (2) reported that post-endoscopic infections are mainly due to improper disinfection and assessment of endoscopes. Cowen also reported that the infections associated with endoscopic procedures are mainly due to contaminated environments in hospitals, instruments used for the endoscopic procedures and through endogenous flora of patients (18). Improper cleaning and disinfection of the endoscopes are the principal risk of infections in post-endoscopy (19). Therefore, use of standard sterile water in endowasher rinsing bottles should be enforced. There are also a few reported cases of septicaemia due to endowashers contaminated because of improper cleaning and disinfection procedures (1). Among the organisms causing septicaemia in post-endoscopic patients is *P aeruginosa,* which is widely recognized to be a biofilm producer and possesses intrinsic resistance to various antibiotics.

Biofilm plays an important role in blocking the action of disinfectants used for the cleaning procedures. Thus, when there is biofilm formation in endowashers, they act as a source of contamination of water that is pumped through the tubes (20, 21). From our study, it is clear that endowashers play an important role in the spread of infection in post-endoscopic procedures. This emphasizes the need for monitoring water quality and control of infection in the water used in endowashers. Periodical microbiological analysis of the water must be included in the recommendations and guidelines. Our study also stresses the need for proper disinfection in endowashers to avoid transfer of infections to patients after endoscopy.

Authors' note

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