

Original Research

A comparative analysis of detergent versus hypochlorite cleaning on environmental contamination

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ABSTRACT:

Background: Clostridium difficile is the major infective cause of hospital-acquired diarrhoea. The present study was conducted to compare detergent versus hypochlorite cleaning on environmental contamination. **Materials & Methods:** The present study comprised of hypochlorite (1000 ppm available chlorine) (Group I) and neutral liquid detergent (1/1000 dilution) (Group II). Two wards with similar patient mix, design, and layout were cleaned with one or other regimen for 6-12 months periods. **Results:** The number of toxin positive patients was 40 in group I and 25 in group II, percentage of culture positive environmental sites was 32% in group I and 36% in group II and percentage of positive HIPs was 2.6% in group I and 9.4% in group II. The difference was non-significant ($P > 0.05$). The frequency of *C. difficile* culture positive sites on floor was 22% in group I and 28% in group II, in bedframes was 19% in group I and 16% in group II, in radiators was 41% group I and 52% group II, in toilet floor was 58% group I and 70% group II, in sluite floor was 32% in group I and 54% in group II and in cleaners floor was 12% in group I and 32% in group II. The difference was significant ($P < 0.05$). **Conclusion:** The use of hypochlorite for environmental cleaning may significantly reduce incidence of *C. difficile* infection. **Key words:** Clostridium difficile, Detergent, Hypochlorite

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INTRODUCTION

Clostridium difficile is the major infective cause of hospital-acquired diarrhoea. Despite increasing awareness of the need to avoid high-risk antibiotics in susceptible elderly patients, reports of *C. difficile* infection (CDI) continue to increase.¹ In addition to hands, environmental contamination is considered an important factor in hospital-acquired infections. However, there is little evidence of how best to decontaminate the hospital environment.²

A number of studies have attempted to determine the most effective method of cleaning, but it remains an unresolved issue. Much of the uncertainty relates to the multifactorial nature of nosocomial infection and the difficulties inherent in controlling the large number of variables that impact upon infection rates.³ In addition, conflicting national and international guidelines create further confusion. National recommendations for cleaning source isolation

facilities indicate that hot water and neutral detergent is sufficient for most situations, but additional disinfection may be required if pathogens or harmful bacteria are present, as they can survive in the environment for prolonged periods of time, for example the spores of *Clostridium difficile*.⁴

Daily detergent-based cleaning of side-rooms used for isolation of patients can lead to reduction of all environmental samples being contaminated. with *C. difficile*.⁵ Cleaning agents also show marked differences in their ability to promote sporulation of *C. difficile*, which can be enhanced when cultured in faeces exposed to chlorine-free cleaners.⁶ The present study was conducted to compare detergent versus hypochlorite cleaning on environmental contamination.

MATERIALS & METHODS

The present study comprised of hypochlorite (1000 ppm available chlorine) (Group I) and neutral liquid detergent (1/1000 dilution) (Group II). Two wards with similar patient mix, design, and layout were cleaned with one or other regimen for 6-12 months periods.

Surveillance for environmental and hand contamination by *C. difficile* was performed monthly. Sites were sampled in a systematic manner with sterile cotton wool swabs moistened with 0.25% Ringer's solution and cultured immediately for *C. difficile*. *C. difficile* isolates were recovered from

environmental samples by culture on cycloserine cefoxitin supplemented agar without egg yolk but containing 5 mg/L lysozyme for 48 h in an anaerobic cabinet at 37°C. All *C. difficile* isolates were recognized by their characteristic colonial morphology and odour. Hands of 20 healthcare workers were sampled at one time each month using a standard hand impression plate technique on to lysozyme CCA medium. CDI was diagnosed on request by laboratory detection of cytotoxin, neutralized by in diarrhoeal faecal samples. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Comparison of two groups

Parameters	Group I	Group II	P value
Number of toxin positive patients	40	25	0.01
Percentage of culture positive environmental sites	32	36	0.91
Percentage of positive HIPs	2.6	9.4	0.02

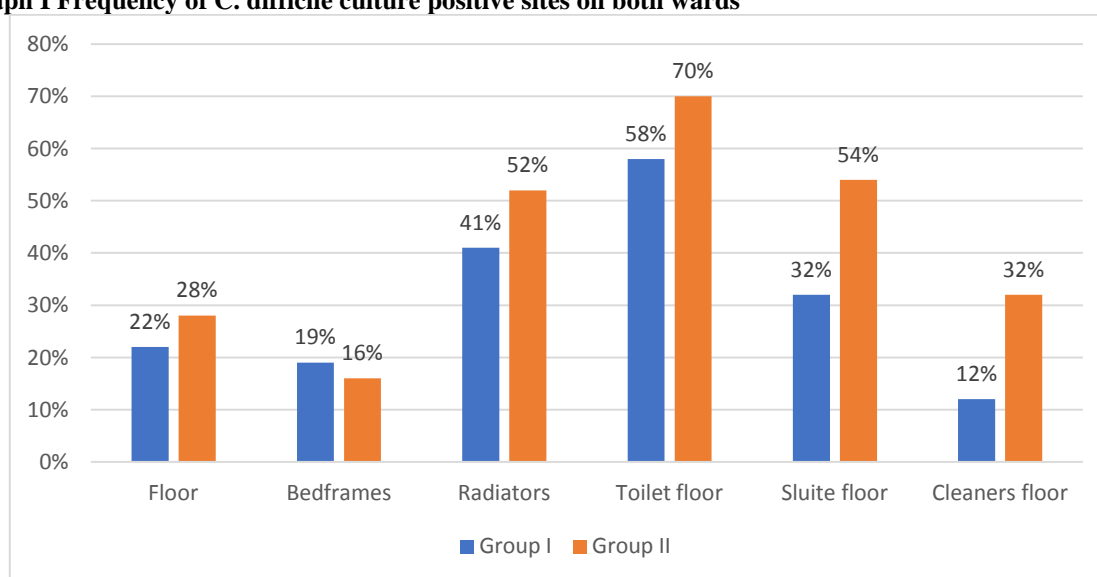
Table I shows that number of toxin positive patients was 40 in group I and 25 in group II, percentage of culture positive environmental sites was 32% in group I and 36% in group II and percentage of positive HIPs was 2.6% in group I and 9.4% in group II. The difference was non-significant ($P > 0.05$).

Table II Frequency of *C. difficile* culture positive sites on both wards

Site	Group I	Group II	P value
Floor	22%	28%	0.81
Bedframes	19%	16%	0.90
Radiators	41%	52%	0.05
Toilet floor	58%	70%	0.04
Sluite floor	32%	54%	0.02
Cleaners floor	12%	32%	0.01

Table II, graph I shows that frequency of *C. difficile* culture positive sites on floor was 22% in group I and 28% in group II, in bedframes was 19% in group I and 16% in group II, in radiators was 41% group I and 52% group II, in toilet floor was 58% group I and 70% group II, in sluite floor was 32% in group I and 54% in group II and in cleaners floor was 12% in group I and 32% in group II. The difference was significant ($P < 0.05$).

Graph I Frequency of *C. difficile* culture positive sites on both wards



DISCUSSION

Patients posing a cross-infection risk are often nursed in source isolation, usually a single room. Source isolation aims to reduce the potential for cross-infection.⁷ Adequate cleaning of source isolation facilities is important, in order to minimise the risk of transmitting nosocomial infection via the environment and fomites.⁸ While there is debate about the exact role of the environment in the spread of healthcare-associated infections (HAIs), it is largely accepted that it does play a role.⁹ The present study was conducted to compare detergent versus hypochlorite cleaning on environmental contamination.

In present study, number of toxin positive patients was 40 in group I and 25 in group II, percentage of culture positive environmental sites was 32% in group I and 36% in group II and percentage of positive HIPs was 2.6% in group I and 9.4% in group II. Wilcox et al¹⁰ determined whether cleaning with a hypochlorite disinfectant was better than using neutral detergent in reducing the incidence of *C. difficile* infection (CDI). They examined 1128 environmental samples in two years, 35% of which grew *C. difficile*. There was a significant decrease of CDI incidence on ward X, from 8.9 to 5.3 cases per 100 admissions using hypochlorite, but there was no significant effect on ward Y. On ward X the incidence of CDI was significantly associated with the proportion of culture-positive environmental sites. On ward Y the only significant correlation between CDI and *C. difficile* culture-positive environmental sites was in patient side-rooms. The total daily defined doses of cefotaxime, cephadrine and aminopenicillins were similar throughout the trial.

We found that frequency of *C. difficile* culture positive sites on floor was 22% in group I and 28% in group II, in bedframes was 19% in group I and 16% in group II, in radiators was 41% group I and 52% group II, in toilet floor was 58% group I and 70% group II, in sluice floor was 32% in group I and 54% in group II and in cleaners floor was 12% in group I and 32% in group II. Patel et al¹¹ compared the effectiveness of cleaning with detergent, cleaning with detergent followed by sodium hypochlorite and cleaning with detergent after enhanced training for domestic staff. Frequent 'hand touch' sites in two isolation rooms were sampled, using contact plates. A total of 567 plates were collected. Bacterial total viable counts (TVCs) and environmental meticillin-resistant *Staphylococcus aureus* (MRSA) were used as surrogate markers to compare the efficacy of the cleaning methods. The results indicate that cleaning with water and detergent followed by sodium hypochlorite achieved significantly lower TVCs for most sampling sites, but only significantly lower environmental MRSA detections from a minority of sample sites. No one method of cleaning consistently eliminated MRSA from the environment. These results provide some preliminary evidence for the use

of detergent and hypochlorite cleaning within source isolation facilities.

Kaatz et al¹² isolated *C. difficile* from 31% of ward environmental samples. The outbreak ended after the introduction of disinfection with unbuffered hypochlorite (500 ppm available chlorine), and surface contamination decreased to 21% of initial levels. Phosphate buffered hypochlorite (1600 ppm available chlorine, pH 7.6) was found to be more effective at reducing environmental *C. difficile* levels (98% reduction in surface contamination). They found that contamination with *C. difficile* may persist after environmental cleaning with hypochlorite. Indeed, it is clear that once a hospital environment becomes contaminated, it is very difficult to render it *C. difficile* free.

Dharan et al¹³ compared the use of detergent versus disinfectant for cleaning environmental surfaces not contaminated with body fluids and found using detergent alone was associated with significantly higher bacterial colony counts. They also examined the impact on HAIs and found no commensurate change in the incidence of nosocomial infection in the 1117 patients observed during the study, concluding that enhanced disinfection does not impact HAIs.

Dancer¹⁴ suggests that a quantitative assessment of micro-organisms found within a specified area is a relevant measurement of bacteriological cleanliness, because a heavy burden of microbes (regardless of the type) on surfaces, such as frequent hand touch sites, may pose a cross-infection risk to vulnerable patients.

CONCLUSION

Authors found that that use of hypochlorite for environmental cleaning may significantly reduce incidence of *C. difficile* infection.

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