



(Q – 280)

Determining the Ability of Surface Wipes *Staphylococcus aureus* from

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Abstract

Introduction: Disinfection regimens adopted in ICUs in the UK include the use of disinfectant wipes. They are used to disinfect surfaces which are commonly contaminated with bacterial pathogens. We used our 3-step protocol to test the ability of wipes to remove, kill and prevent the transfer of bacteria from contaminated to clean surfaces.

Methods: Meticillin-resistant or -susceptible *Staphylococcus aureus* ($6 \log_{10}$ CFU) were inoculated onto steel discs with or without organic load and dried. Commercially available wipes containing disinfectant (DIS), detergent (DET) or natural antimicrobial (NA) were used. Step 1: bacterial removal was assessed by mechanically rotating wipes against surfaces for 10s at 60 rpm, exerting a weight of 100 ± 5 g. These parameters were based on *in situ* usage of wipes in ICUs. Discs were transferred to a neutralizing solution and remaining bacteria were re-suspended and counted. Step 2: bacterial transfer from wipes was assessed by eight mechanical adpression transfers to agar/neutralizer plates. Step 3: antimicrobial activity was measured by direct inoculation of the wipes followed by neutralization after 10s contact and enumeration.

Results: In comparative studies of dirty and clean surfaces, respectively, DET produced a 1.73 ± 0.21 and $1.73 \pm 0.25 \log_{10}$ bacterial removal, DIS achieved a 1.9 ± 0.55 and $2.57 \pm 0.51 \log_{10}$ bacterial removal and NA wipes produced a 3.63 ± 0.43 and $4.54 \pm 0.63 \log_{10}$ bacterial removal. DET and NA wipes transferred each strain in numbers too numerous to count onto consecutive agar/neutralizer plates. Cell numbers transferred by DIS were mostly countable and decreased through the adpression series. DET had no antimicrobial activity, NA wipes produced $<1 \log_{10}$ reduction and DIS achieved a 2.68 ± 0.33 and $3.55 \pm 0.64 \log_{10}$ reduction in the presence and absence of organic load, respectively.

Conclusion: The use of the 3-step protocol allowed a risk assessment to be made for using wipes in ICUs. Wipes can potentially result in cross-contamination of surfaces when initially high microbial contamination levels are present. We recommend that a wipe is not to be used on consecutive surfaces, but only on a small area and discarded immediately after use.

Introduction

- The ability of *S. aureus* to contaminate and persist in the hospital environment has been well documented.¹
- We have observed the use of wipes in ICUs in Wales; hospital staff use wipes to decontaminate surfaces proximal to patients and use a single wipe on consecutive surfaces.
- Therefore, they are potential sources of bacterial cross-contamination, which emphasises the need to remove and effectively kill bacteria from these surfaces.
- We have developed a reproducible 3-step protocol to evaluate the disinfection efficiency of wipes in a manner which reflects usage in practice.²
- In this study, we tested the efficacy of three commercially-available wipes, two of which are currently being used in ICUs in Wales.

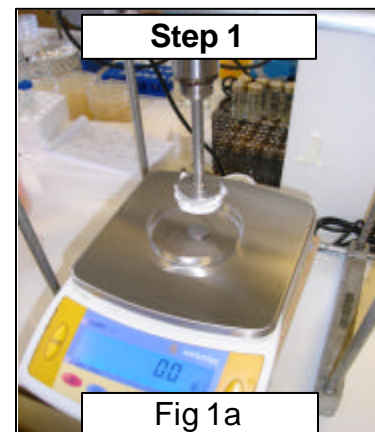
Methods

- Genetically distinct *S. aureus* ICU strains of MSSA and MRSA which were the cause of bacteraemias in patients were provided by the University Hospital of Wales (UHW, Cardiff, UK).
- Wipes containing disinfectant (DIS), detergent (DET) and a natural antimicrobial (NA) were used.

Step 1

Measuring the efficacy of wipes to remove bacterial contamination from surfaces

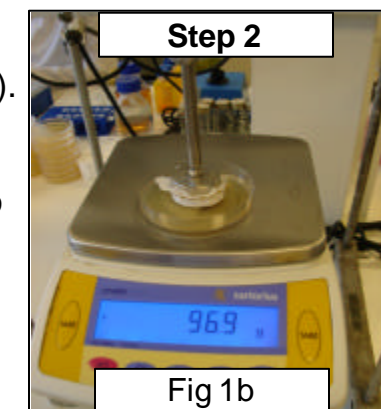
- Steel discs were inoculated with *S. aureus* ($\sim 6-7 \log_{10}$ CFU/ disc) containing BSA to mimic either clean or dirty conditions.
- A drill was used to apply wipes to the surfaces for 10 sec at 60 rpm, exerting a weight of 100 ± 5 g (Fig. 1a).
- These parameters were chosen following the observation of staff using wipes in ICUs, thus reproducing *in situ* usage.
- Steel discs were transferred to neutralizer and viable cell counts performed to calculate the log number of cells removed from surfaces.



Step 2

Measuring bacterial transfer from wipes

- Following the application of wipes to contaminated surfaces, adpression tests were performed (Fig 1b).
- Eight TSA plates containing neutralizer were consecutively inoculated by pressing the wipe onto their surface, exerting a weight of 100 ± 5 g (Fig. 1b).
- These parameters were chosen following the observation of staff using wipes in ICUs, thus reproducing *in situ* usage.



Step 3

Measuring the bactericidal activity of wipes by direct inoculation

- Test and control wipes were directly inoculated with bacteria ($\sim 6-7 \log_{10}$ CFU/wipe) containing BSA to mimic either clean or dirty conditions.
- Following 10 sec exposures, the wipes were transferred to neutralizer and viable counts performed to calculate the bactericidal effect.²

to Remove, Kill and Prevent the Transfer of Contaminated Surfaces

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Results

Step-1

Measuring bacterial removal

- In comparative studies of dirty and clean surfaces, respectively, DET produced a 1.73 ± 0.21 and 1.73 ± 0.25 \log_{10} bacterial removal, DIS achieved a 1.9 ± 0.55 and 2.57 ± 0.51 \log_{10} bacterial removal and NA wipes produced a 3.63 ± 0.43 and 4.54 ± 0.63 \log_{10} bacterial removal.
- In most cases, NA wipes achieved a significantly higher bacterial cell removal than the DET and DIS wipes in the presence and absence of organic load ($P < 0.05$) (Fig 2).

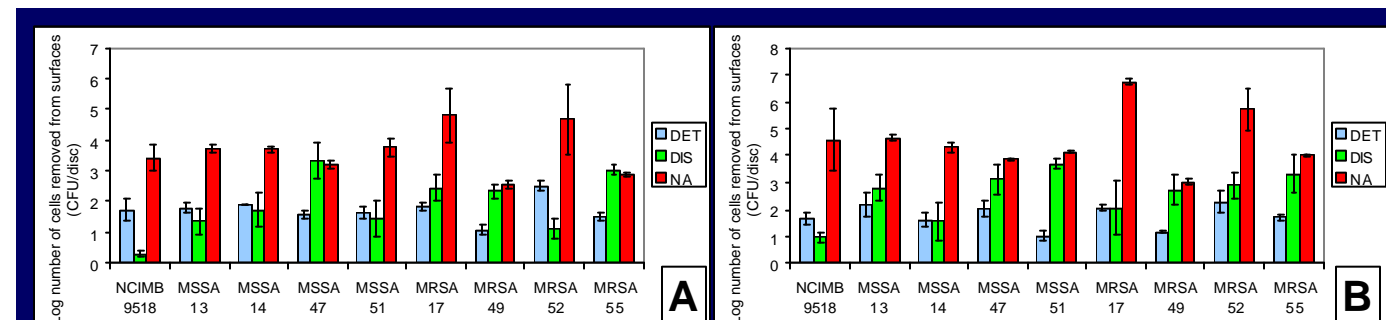


Fig 2: The mean number of MSSA and MRSA cells (four strains of each) removed from (a) dirty and (b) clean surfaces after wipes were applied for 10 sec ($n = 3$).

Step-2

Measuring bacterial transfer from wipes

- Adpression tests revealed that uncountable numbers (>100 CFUs) of each strain were transferred from the surface of DET and NA wipes onto eight consecutive agar/neutralizer plates.
- DIS wipes transferred some strains in numbers too numerous to count. In other cases, however, wipes transferred countable numbers which decreased through the adpression series'.

Step-3

Measuring bactericidal activity of the wipes

- DET wipes had no antimicrobial activity.
- NA wipes produced <1 \log_{10} reductions.
- DIS achieved a 2.68 ± 0.33 and 3.55 ± 0.64 \log_{10} reduction in the presence and absence of organic load, respectively (Figure 3).

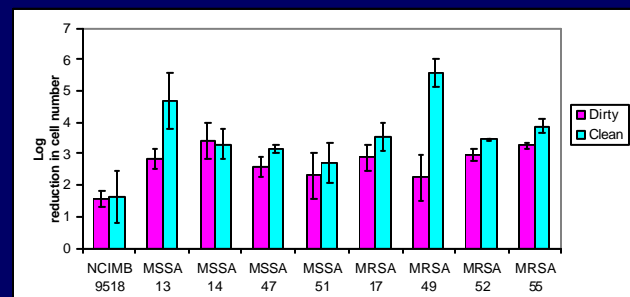


Fig 3: The bactericidal activity of DIS wipes following 10 s exposures ($n = 3$).

Conclusions

- The 3-step method is a simple, rapid, robust and reproducible method and a useful tool for the assessment of the ability of wipes to disinfect surfaces.
- Overall, NA wipes achieved a higher bacterial cell removal than DET and DIS wipes.
- NA and DET wipes have little and no antimicrobial activity, respectively, against *S. aureus*.
- The survival of bacteria on NA and DET wipes led to repeated microbial transfer.
- DIS wipes killed high numbers of cells but they still could not prevent cross-contamination.
- The use of the protocol has highlighted concerns as to the suitability of wipes currently being deployed in Welsh ICUs.
- If these wipes encounter similarly high levels of contamination levels in practice the survival of MRSA and MSSA on the wipe material could lead to the cross-contamination of other surfaces.
- Wipes should be applied in a manner to reduce the risk of microbial spread – a 'One wipe – one application – per surface' policy.
- NA wipes would work best if the policy is implemented since they removed higher levels of contamination after first use. It is likely, however, that they will spread bacteria if used on more than one surface at a time.

Acknowledgements

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References

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- Williams, GJ *et al.* (2007). *J Hosp Infect* 67, 329-35