Journal of Hospital Infection 95 (2017) 228–230

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Letters to the Editor

Preoperative skin antisepsis — it ain't what you do but the way that you do it

Sir,

Having read the letter by Assadian and Leaper we would like to support the view that the mode of application of preoperative skin antiseptics is as important as their formulation to prevent surgical site infections.[1] However, we would like to point out that it is not a specific applicator achieving success, but the mode of application. To support this view we compared the application of 2% (w/v) chlorhexidine gluconate in 70% (v/v) isopropanol from a commercially available sterile applicator (ChloraPrep, Becton Dickinson, Franklin Lakes, NJ, USA) with the application of the same formulation as a non-sterile bulk solution by using sterile gauze swabs and forceps. We examined the reduction of resident microbial flora of the forehead of 20 volunteers as an example of skin rich in sebaceous glands, where resident skin flora is more difficult to inactivate. Areas of 20 cm^2 were treated for 30 s either with the commercially available applicator or with gauze swabs soaked in bulk solution of the antiseptic. The areas were rubbed intensively with the corresponding device, exerting a suitable but non-stressing pressure to the test site. Immediately after application, the areas were swabbed with a standard technique.[2] Swabs were eluted with a validated neutralizing solution. Microbial $\log_{10}$ reduction was calculated using results of an untreated area of the forehead as a baseline. The $\log_{10}$ reduction achieved with the commercially available applicator was 1.54 ($\pm$0.66), whereas the reduction with the bulk solution using gauze swabs and forceps was 2.34 ($\pm$1.22). This difference was significant ($P = 0.008$) in a Wilcoxon signed ranks test. The mode of application therefore appears relevant in preoperative skin antisepsis — for example, appropriate volume and contact time — but the specific applicator seems not to be relevant. We conclude that it is important to rub the skin with an appropriate antiseptic, to use appropriate mechanical action, and to apply good clinical practice.

Conflict of interest statement
The authors are employees of Ecolab, manufacturer of disinfectants and antiseptics.

Funding sources
None.

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B. Meyer[a,*]
E. Wishart[b]
[a]*Ecolab Deutschland GmbH, RD&E HC EMEA, Monheim am Rhein, Germany*
[b]*Ecolab UK Ltd, Garforth, Leeds, UK*

* Corresponding author. Address: Ecolab Deutschland GmbH, RD&E Healthcare EMEA, Ecolab Allee 1, Monheim am Rhein, 49789, Germany. Tel.: +49 2173 5991780; fax: +49 2173 5991624.
E-mail address: bernhard.meyer@ecolab.com (B. Meyer).

Available online 18 December 2016

http://dx.doi.org/10.1016/j.jhin.2016.12.013

Tanning the bugs — a pilot study of an innovative approach to stethoscope disinfection

Sir,

Healthcare-associated infections (HCAIs) are a major public health problem and up to 32% of HCAIs could be prevented.[1] Possible causes of HCAI transmission are medical devices not properly disinfected after their use; in particular the stethoscope, a symbol of medicine, has received particular attention: 85% of stethoscopes have been reported to be reservoirs of bacteria, including pathogens.[1] There is also evidence that two-way transfer of micro-organisms is possible between skin and stethoscope.[1–7] Our study aimed to evaluate the effectiveness of an innovative device for the disinfection of stethoscope membranes, contaminated by chest auscultation in a real setting.

A pilot study with pre/post design was performed between March and April 2015 in the Department of Molecular and Developmental Medicine, University of Siena, Italy. Ten resident students were enrolled as volunteers. We used a device emitting short-wavelength ultraviolet (UV-C; 255–280 nm) light through a light-emitting diode (LED). UV-C has a biocidal effect on microbes, altering their DNA/RNA.[8] When the head of the stethoscope is placed on the device, a micro-switch activates the UV-C LED, whose irradiation for 5 min disinfects the stethoscope membrane. When the head of the stethoscope is removed, the LED automatically switches off. This prevents any possible harm to patients due to UV-C light.

The test stethoscope was used to auscultate 10 points on the chest of the 10 volunteers; each volunteer was examined twice. After the first auscultation the head of the stethoscope was disinfected with the device for 5 min and the membrane was then cultured on plate count agar; after the second auscultation, the stethoscope head was placed directly on to the culture plate without treatment. Between every treatment and control the stethoscope was disinfected with alcohol, in order to standardize the baseline level. Plates were incubated at 36°C for 48 h, after which the numbers of colony-forming units (cfu) were determined. Descriptive and inference analyses were performed. Sign test for matched pairs was used to compare the number of cfu after culture of treated and untreated stethoscopes. Stata® SE, version 12.1 (StataCorp., College Station, TX, USA) was used to perform the analysis. $P < 0.05$ was considered statistically significant.

Table I shows cfu recorded for stethoscope membranes, treated or not treated (controls) with the UV-C device after auscultation. For the controls, the mean number of cfu was 75.9 (SD: 125.7), compared with 9.5 cfu (SD: 18.8) for treated membranes. The median for the controls was 38 cfu with an interquartile range (IQR) of 12.5–68.75; the median for the treated stethoscopes was 2.5 cfu (IQR: 0–10.5). No cfu were detected in five out of 10 cultures from treated stethoscopes. The other five cases had a mean of 132.6 (SD: 165.1) cfu on untreated tests and a mean of 19 (SD: 23.8) cfu on treated tests. The average cfu reduction between the two groups was 85.7% ($P = 0.002$).

This study confirms that bacteria transfer from skin to stethoscopes. Second, a device taking advantage of the well-known biocidal activity of UV-C can be miniaturized through the use of a UV-C LED source.[7] The adoption of a physical approach for disinfection may be an advantage because of lack of resistance to UV-C for micro-organisms involved in HCAIs, which is not the case for chemical disinfectants. Our device was found practical to use. It has been designed to turn on and off automatically; its small size makes it attachable to users' uniforms or clothing so that stethoscope users can always have a device at their immediate disposal. One possible reason for lack of compliance with current stethoscope hygiene procedures is the inconvenience of finding disinfectant and/or cleaning materials. Finally, a wearable device would provide a continuous reminder to decontaminate a stethoscope.

Some precautions would need to be considered before adopting the device: (i) treated surfaces should be dry to make UV-C most effective: (ii) UV-C treatment could cause faster deterioration of stethoscope membranes, although exposures are brief and radiant power is relatively low; moreover, other methods of disinfection are also likely to damage membranes; (iii) 5 min of irradiation may be a long time between patients in a busy hospital and in emergency settings; (iv) a complete inactivation of micro-organisms was not achieved in all cases, but LED technology is improving and higher performance diodes are almost ready for the market. In any case, a reduction in bacterial load, rather than in absolute sterility, may be all that is required. The main limitation of this pilot study was the low number of samples tested; however, we believe that the aims of the pilot study to assess both the effectiveness and the feasibility of the device were achieved. Our next goal is to perform larger studies on patients in real healthcare settings, such as a hospital ward or general practitioner's office.

Table I
Numbers of colony-forming units from cultures of control and UV-C-treated stethoscope membranes

Case no.	Colony-forming units	
	Controls	Treated
1	15	0
2	3	0
3	5	0
4	57	5
5	38	0
6	38	15
7	427	61
8	35	0
9	74	5
10	67	9

Acknowledgements

We would like to thank the study participants.

Conflict of interest statement
G. Messina, S. Burgassi, D. Messina, and G. Cevenini are co-founders of a start-up company named 'egoHEALTH', which is aiming to apply the innovative approach described in this publication. M. Tani reports personal fees from egoHEALTH Ltd during the conduct of the study.

Funding sources
None.

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G. Messina[a,b,*]
D. Rosadini[b]
S. Burgassi[a]
D. Messina[c]
N. Nante[a,b]
M. Tani[d]
G. Cevenini[e]

[a]*Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy*

[b]*Post Graduate School of Public Health, University of Siena, Siena, Italy*

[c]*Monte dei Paschi Foundation of Siena, Siena, Italy*

[d]*FeT Elettronica S.n.c., via A. Volta 28, Poggibonsi (Siena), Siena, Italy*

[e]*Department of Medical Biotechnology, University of Siena, Siena, Italy*

* Corresponding author. Address: Department of Molecular and Developmental Medicine, University of Siena, via Aldo Moro, 2 - 53100 Siena, Italy. Tel.: +39 0577 234139; fax: +39 0577 234090.
E-mail address: gabriele.messina@unisi.it (G. Messina).

Available online 10 December 2016

http://dx.doi.org/10.1016/j.jhin.2016.12.005