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Original Article

Patient safety and stethoscopes[☆]Ian James Bruce Young^{*}

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ARTICLE INFO

Article history:

Received 8 June 2014

Accepted 12 June 2014

Available online 23 July 2014

Keywords:

Cross infection

Nosocomial infections

Quality improvement

ABSTRACT

Background: It has been suggested that the use of stethoscopes may transmit infection between patients and yet stethoscope cleaning protocols lack consistency of guidance as to where, when and how stethoscopes should be cleaned. We have assessed the difference in microbiological colonisation between non-dedicated and patient dedicated stethoscopes and between the stethoscope diaphragm and neck.

Methods: An observational study over an 8-day period at a secondary care hospital. We analysed 104 samples comprising matched diaphragm and neck data for each of 26 non-dedicated and 26 patient dedicated stethoscopes. The diaphragm and neck of each stethoscope were swabbed and processed using standard microbiology techniques.

Results: 98% of stethoscopes were colonised. There was a lack of evidence for a true difference in colonisation levels between the stethoscope diaphragm and neck ($n = 104$, $p = 0.752$ (OR1.000 95%CL (0.230–4.345)) Cohen's effect size index = 0.000) or between dedicated and non-dedicated stethoscopes ($n = 104$, $p = 1.000$ (OR3.118 95%CL (0.121–80.190))).

Conclusions: Importance in maintaining the hygiene of stethoscopes is underplayed. An effective patient safety culture will not merely respond to recognised risk but will identify and mitigate potential risk. These data suggest the entirety of the stethoscope will become colonised regardless of its environment. A good patient safety intervention will make doing the right thing the easy thing. Here we argue for cleansing the entirety of the stethoscope before and after patient contact.

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Stethoscopes are used almost universally in medical practice. It is difficult to assess the nosocomial risk of the bacterial colonisation of stethoscopes. You can show that stethoscopes act as reservoirs for potential nosocomial pathogens but there is yet to be a documented case of one causing a nosocomial infection. An effective patient safety culture will

not merely respond to recognised risk but will identify and mitigate potential risk. Studies show the median colonisation rate for stethoscope diaphragms to be 91%.^{1–10} Many of these colonisers are environmental and skin flora but in the wrong place these still pose a risk to the most vulnerable patients; such as those with indwelling devices and the

[☆] This work was conducted in the following departments of the Royal Infirmary of Edinburgh, A respiratory ward, Combined Assessment Area, Intensive Treatment Unit (ITU) and Neonatal ITU.

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<http://dx.doi.org/10.1016/j.jpsic.2014.06.005>

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immunocompromised. Audited cleaning programmes and undergraduate medical curricula increasingly focus on hand hygiene but underplay the importance of inanimate objects in the clinical setting. There is evidence that bacterial contamination of the inanimate environment plays a role in the epidemic and endemic transmission of multi-resistant microorganisms.¹¹ Indeed correlation has been shown between isolates from inanimate objects and epidemic infections.¹² Furthermore, it has been documented that *Micrococcus* inoculated on a stethoscope diaphragm is transmissible to human skin.⁷

The literature consistently demonstrates it is not the cleaning method but the frequency of cleaning that best predicts stethoscope colonisation. Specifically, regular cleaning decreases Colony Forming Units (CFU) of microorganisms isolated from stethoscopes,^{3,5,8} and the median reduction in CFU across all cleaning methods is 93.4%.^{6–9,13–17} When comparisons have been made the literature is consistent that no significant difference in efficacy exists between cleaning with ethanol based cleaners, isopropyl alcohol, alcohol foams, non-ionic detergents and alcowipes.^{6,9,17} The inability for alcohol to safely remove *C. difficile* and certain viruses remains a limitation of this form of cleaning.¹⁸

As the Department of Health guidance indicates, in adhering to the objective of patient safety, guidance can be made in the absence of an evidence-base where common-sense prevails.¹⁹ For this reason doctors are advised not to wear a necktie, other than a bow tie, during patient care activity. It is right and proper that a rigorous academic approach should be taken to identifying risk but this should not be at the cost of common sense. The creation of a high reliability patient safety culture necessitates focus on every detail. Stethoscope cleaning protocols lack consistency of guidance as to where, when and how stethoscopes should be cleaned. Inconsistency in guidance breeds scepticism about its validity. Previous data indicate that both the earpiece and diaphragm require cleaning.^{3,20} No attention however has been paid to the neck of the stethoscope – the one area that is most likely to be handled by the clinician when separating the limbs of the stethoscope to facilitate insertion of the earpieces. This study was designed to assess the difference between the microbiological colonisation of the stethoscope diaphragm and neck. Additionally there is little guidance about how cleaning should differ between clinical environments. This study investigated the evidence as to whether non-dedicated stethoscopes are more or less likely to be colonised than patient dedicated stethoscopes.

1. Methods

This study was an observational study across four wards at the Royal Infirmary of Edinburgh. These wards were Combined Assessment Area (Combined), Respiratory (ward 204) (Resp), ITU (ward 118) (ITU), and Neonatal ITU. The sample comprised 52 stethoscopes ($n = 13$ per ward). Samples were taken from both the diaphragm and neck of each stethoscope giving a total of 104 samples. These data were collected between 20 and 27 July 2011.

The study was focused upon two comparisons: between the diaphragm and the neck of each stethoscope, and between dedicated and non-dedicated stethoscopes. For the purposes of this study these terms are defined in Table 1.

On wards with non-dedicated stethoscopes, the participating HCP (all grades (data not recorded) $n = 26$) completed a questionnaire about stethoscope disinfection practices. The questionnaire design was based upon local Trust guidelines. The participants were not blinded as the nature of the study was explained to gain consent. Nobody declined to participate. Initially the hands of the investigator were cleansed with alcoholic hand sanitizer (Softalind, B. Braun, UK). Verbal consent from the HCP to swab their stethoscope was obtained. In the case of ITU and Neonatal ITU, consent was granted by senior clinicians on these wards. Care was taken to ensure that once the stethoscope was identified neither the neck nor the diaphragm came into contact with another surface or skin. All dedicated stethoscopes had been cleaned with actochlor plus while the patient bed space was vacant and were sampled from occupied bed spaces.

The diaphragm and the neck of each stethoscope were individually swabbed for 30 s with a cotton swab pre-moistened with a dousing of 5 ml 0.9% Sodium Chloride Intravenous Infusion BP (B. Braun, Melsungen, Germany). Each swab was labelled with an anonymous sample identifier and inserted into bacterial transport medium for transport to the laboratory. The lag time between collection and inoculation did not exceed 4 h.

Each swab was inoculated onto Columbia blood agar, chocolate agar, MacConkey agar and finally an MRSA chromogenic agar. Blood and chocolate plates were incubated at 37 °C in 5% carbon dioxide for 96 h whilst MacConkey and MRSA plates were incubated aerobically at 37 °C for 24 h.

Following incubation the CFU numbers were estimated. Bacteria were then identified by using standard methods used in the diagnostic laboratory. Briefly, macroscopic appearance

Table 1 – Definitions of stethoscope terms for the purposes of this study.

Diaphragm	This consists of both the membranous tympanic portion of the stethoscope and the encasing plastic rim.
Neck	This consists of the plastic casing bordered superiorly by the metal-plastic junction on each ear limb and inferiorly by a horizontal line drawn half way along the plastic casing running from the diaphragm to the division of the ear limbs.
Dedicated stethoscopes	Those used on ITU and Neonatal ITU and are patient dedicated: i.e. there is a stethoscope specific to each patient, used only on that patient, and cleaned between each new admission with actichlor plus (Ecolab Ltd.)
Non-dedicated stethoscopes	Those used on Combined and Resp and are Health Care Practitioner (HCP) dedicated: i.e. they are owned by one specific HCP and used on each patient they examine.

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