

Original Research Article

Stethoscopes: a potential source of hospital acquired infection

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ABSTRACT

Background: Nosocomial infection has been recognized for over a century as both a critical problem affecting the quality of health care and a leading cause of morbidity, mortality and increased health care cost. Stethoscopes because of their universal use by medical professional, can be a potential source of nosocomial infections. The study was conducted to determine the bacterial contamination of stethoscopes used by health care staff as well as the practices used for cleaning them.

Methods: A structured questionnaire was administered to health workers and the surface of the diaphragm of their stethoscopes swabbed for bacteriological analysis using standard techniques.

Results: Of the 65 stethoscopes sampled, 33(50.8%) showed bacterial growth. All the bacterial isolates were found to be gram positive organism. The isolates were *Micrococcus spp.* (35.8%), *Coagulase negative staphylococcus (CONS)* (30.8%), *Bacillus spp.* (15.4%), *Staphylococcus aureus* (10.3%) and *Diphtheroids* (7.7%).

Conclusions: Further research is needed to solve the question whether stethoscope contamination actually results in infection in the patient. However strict adherence to disinfection practices by health workers can minimize cross-contamination and ensure patient safety in hospital environments.

Keywords: Hospital acquired infections, Nosocomial infections, Stethoscopes

INTRODUCTION

Nosocomial infections remain a significant hazard for hospitalized patients and health care workers are potential sources of these infections, with many of the pathogens transmitted by hand carriage.¹ Hospital infections are important since they cause high mortality and in addition they are preventable.² Hospital environment is a reservoir of wide varieties of microorganisms which are frequently reported colonizing in medical equipment.³ Stethoscopes are essential tools of the medical profession and because of their universal use might be a source of microorganisms that cause nosocomial infections. Stethoscopes come in direct contact with numerous

patients daily and their disinfection after each use is not an established practice.⁴ Several studies in medical literature have demonstrated that many physicians' stethoscopes are contaminated with pathogenic bacteria and could serve as a mode for transmission of infection.^{4,6} The aim of the present study is to determine the bacterial contamination of stethoscopes used by health care staff as well as the practices used for cleaning them.

METHODS

This prospective, cross sectional study was conducted by the Department of Microbiology, ACS Medical College and Hospital during May 2017.

Health Care Personnel (HCP) including consultants, medical officers, residents and staff nurses of the Medicine, Surgery, Paediatrics, Gynaecology, Emergency Departments and the Intensive Care Unit (ICUs) were included in this study. Health care Personnel who use stethoscopes at place of work, were randomly selected.

Health care providers once participated in the study were excluded from repeat enrollment so that each person submit his or her stethoscope only once. Informed consent was taken from each of the participant before collecting sample. A total of 65 health care personnel participated in the study and the same number of stethoscopes was sampled. A study questionnaire was given to participant to collect data regarding the number of years in practice, gender of respondent to explore the category of the health care personnel and to obtain information on stethoscope cleaning habits like frequency of cleaning and the type of disinfectant used.

Sample was collected from the entire surface of the diaphragm of each stethoscope using a sterile swab moistened with sterile normal saline and was labeled with a serial number. The swabs were inoculated onto the blood agar and Mac Conkey agar and incubated at 37°C for 24 to 48 hours. The growth was identified by standard microbiological procedures such as colony morphology, Gram's staining, growth on differential media and conventional biochemical tests. Methicillin Resistant Staphylococcus aureus (MRSA) was detected by using Cefoxitin 30 µg disc. The collected data was tabulated and analyzed.

RESULTS

Stethoscopes of 65 HCPs from different departments were examined for bacterial contamination which

included 48 (73.8%) females and 17 (26.2%) males. These HCPs were working in different departments like Outpatient department, Medicine ward, Surgery ward, Paediatric ward, Operating room, Gynaecology ward, Labour ward and ICU. Out of the 65 stethoscopes sampled, 33(50.8%) showed bacterial growth and the remaining 32 (49.2%) showed no growth on culture plate. The distribution of the contaminated stethoscopes among the health care personnel is shown in Table 1.

A total of 39 bacteria were isolated as poly microbial growth was detected in 6 stethoscopes. All the bacterial isolates were found to be gram positive organisms. Gram negative organisms were not isolated in this study. The isolated microorganisms are shown in Table 2.

Table 1: Distribution of Contaminated Stethoscopes among the Health Care Personnel.

Health care personnel	Sample tested (%)	Bacterial growth (%)	No growth (%)
Consultants	12 (18.5)	07 (58.3)	05 (41.7)
Residents	16 (24.6)	11 (68.8)	05 (31.2)
Nurses	37 (56.9)	15 (40.5)	22 (59.5)
Total	65 (100)	33 (50.8)	32 (49.2)

Table 2: Microorganisms isolated from the stethoscopes of health care professionals.

Organisms	Number (%)
<i>Micrococcus spp.</i>	14 (35.8)
Coagulase Negative <i>Staphylococcus</i>	12 (30.8)
<i>Bacillus spp.</i>	06 (15.4)
Methicillin Sensitive <i>Staphylococcus aureus</i>	04 (10.3)
Diphtheroids	03 (7.7)
Total	39 (100)

Table 3: Cleaning practices of stethoscopes by health care professionals.

When did you last clean your stethoscope?				
Options	Consultants N=12	Residents N=16	Nurses N=37	Total N=65
Once daily	1 (8.4%)	2 (12.5%)	24 (64.9%)	27 (41.5%)
Once weekly	2 (16.6%)	4 (25%)	09 (24.3%)	15 (23.1%)
Once monthly	6 (50%)	6 (37.5%)	03 (8.1%)	15 (23.1%)
Once yearly	0	3 (18.7%)	0	03 (4.6%)
Never	3 (25%)	1 (6.3%)	1 (2.7%)	05 (7.7%)
What agent did you use to clean your stethoscope?				
Options	Consultants N=9	Residents N=15	Nurses N=36	Total N=60
Soap and water	0	0	2 (5.6%)	02 (3.3%)
Alcohol based	9 (100%)	15 (100%)	34 (94.4%)	58 (96.7%)
Others: specify	0	0	0	0
Do you clean your stethoscopes after seeing each patients?				
Options	Consultants N=12	Residents N=16	Nurses N=37	Total N=65
Yes	0	0	0	0
No	12 (100%)	16 (100%)	37 (100%)	65 (100%)

Among the isolates, *Micrococcus spp.* (35.8%) was the prevalent organism followed by Coagulase negative *staphylococcus* (CONS) (30.8%), *Bacillus spp.* (15.4%), *Staphylococcus aureus* (10.3%) and *Diphtheroids* (7.7%). All the 4 isolates of *Staphylococcus aureus* were found to be methicillin sensitive. No Methicillin Resistant *Staphylococci* were isolated.

Table 3 shows the cleaning practices of stethoscopes by the hcp. Nurses cleaned their stethoscopes more often than doctors. None of the hcps cleaned their stethoscopes after seeing each patients.

DISCUSSION

Hospital acquired infections are frequently caused by microorganisms in the hospital environment and are a significant cause of morbidity and mortality. About one third of all nosocomial infections are preventable.⁷ Contaminated medical equipment and health care staff have been implicated as the carriers of pathogenic organisms. For planning preventive actions, it is essential to identify the reservoirs of microorganisms that cause nosocomial infections. The stethoscope is one of the medical equipment which is universally used by Health care Workers (HCW).

Stethoscope get contaminated by the organisms colonized on the patient's skin, or those resident on the hands or outfits of the health care providers, or when they come in contact with blood and other biological secretions. The universal use of stethoscopes and its direct contact with multiple patients makes it an important potential factor in the dissemination of microorganisms from one patient to another. In hospitalized patient, this means an exposure of an already susceptible host to a higher microbial load. This is of particular relevance while treating renal transplant recipients, immunocompromised, following cardiac surgery.⁸

The results of our study revealed that the rate of bacterial contamination of stethoscopes used by HCPs was 50.8%. Incidence of contamination of stethoscope varies from 30% to 100% in different studies.⁹⁻¹⁴

In the present study, 39 bacteria were isolated from 33 samples as poly microbial growth was detected in 6 samples. All the isolates were gram positive and in contrast to other studies, gram negative organisms were not isolated in this study. However, majority of the study has shown a higher prevalence of gram-positive organisms. This might be because of the direct contact of stethoscopes to human skin flora which contains mostly gram-positive cocci. Also, the life span of gram-negative bacteria is not more than six hours in vitro; the half-life is less than an hour.¹⁵

In this study, next to *Micrococcus spp.*, CONS was the most common isolate. Other organisms isolated were *Bacillus spp.*, Methicillin Sensitive *Staphylococcus*

aureus and *Diphtheroids*. Until recently infections due to CONS were regarded as endogenous in origin. However, there are now increasing reports on the endemic occurrence of distinct strains of CONS. Several outbreaks due to CONS have been reported in neonates and patients undergoing cardiac surgery.⁸ Coagulase negative *Staphylococcus* frequently causes severe systemic infections, including catheter associated and device-associated infections.⁴

It may be conceded that there are no studies linking the presence of microorganisms on the stethoscopes directly to hospital acquired infection. However strategies to reduce the occurrence of hospital acquired infections should take this possibility into account. It is a well known fact that disinfection or removal of contaminated equipment, like thermometer has terminated outbreaks.^{8,16} Therefore cleaning or disinfecting stethoscope can be considered important from the point of minimizing the incidence of hospital-acquired infections.

The study questionnaire revealed that nurses cleaned their stethoscopes more frequently than the consultants and residents. None of the health care workers cleaned their stethoscopes after use in every patient. Majority of the health care personnel preferred alcohol as the disinfecting agent. Cleaning of stethoscopes with 70% ethyl or isopropyl alcohol after every use is recommended by the Centers of Disease Control.¹⁷ Despite these guidelines, proper care of stethoscopes was not at all practiced. Hence health care workers are to be motivated to disinfect at least at the end of the day to ensure patient safety.

CONCLUSION

Stethoscopes represent a moderate to high risk of infection transmission, particularly in vulnerable settings. This problem appears to stem from a lack of formal education on the matter, an absence or ignorance about the hospital protocol. Further research is needed to solve the question whether stethoscope contamination actually results in infection in the patient. However, until such evidence exists, it is wise for individual clinicians to err on the side of prudence and to consider that contaminated stethoscopes are indeed likely to result in clinical infection. Therefore, authors recommend strict adherence to disinfection practices by health workers to minimize cross contamination and ensure patient safety in the hospital.

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