

Original Research Article

Bacterial colonization of stethoscope used in the tertiary care teaching hospital: a potential source of nosocomial infection

Jeyakumari D.^{1*}, Nagajothi S.², Praveen Kumar R.², Ilayaperumal G.², Vigneshwaran S.²

¹Department of Microbiology, Tagore Medical College and Hospital, Chennai, Tamilnadu, India

²Department of Microbiology, Lakshmi Narayana Institute of Medical Sciences, Puducherry, Tamilnadu, India

Received: 20 October 2016

Accepted: 15 November 2016

*Correspondence:

Dr. Jeyakumari D.,

E-mail: karailabscuddalore@yahoo.co.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Hospital acquired infections (HAI) are a major problem in each hospital. HAI remains a significant hazard for hospitalized patients and health care workers are potential sources of these infections. Health care workers can transmit pathogens through their hands and contaminated medical devices such as stethoscopes, Blood pressure cuff etc. Hence we intended to determine the level of bacterial contamination of stethoscopes using in present hospital.

Methods: Total of 50 stethoscopes were sampled before and after cleaning with 70% isopropyl alcohol by using sterile swab soaked in sterile saline. Samples were processed as per standard microbiological procedures.

Results: Out of 50 stethoscopes, 30 (60%) stethoscopes were showing significant bacterial colonization, 7 (14%) showed insignificant colonization, and in 13 (26%) stethoscopes no growth was observed. The bacteria isolated were Methicillin Resistant *Staphylococcus aureus* (MRSA) (14%), Methicillin Sensitive *Staphylococcus aureus* (MSSA) (12%), *Coagulase Negative Staphylococcus* (CNS) (14%), *Klebsiella species* (20%).

Conclusions: Our study concluded that stethoscopes used by health care workers were colonized by both pathogens and non-pathogenic microorganisms. Strict protocol of cleaning the stethoscopes in between the patients will eliminate the colonization and there by spread of infections.

Keywords: Disinfection, Hospital acquired infections, Nosocomial infections, Stethoscopes

INTRODUCTION

Hospital acquired infections (HAI) is a significant problem in each hospital. HAI is a major public health problem worldwide. Nosocomial infections remain a significant hazard for hospitalized patients and health care workers are potential sources of these infections.

Health care workers can transmit pathogens through their hands and contaminated medical devices such as blood pressure cuffs, stethoscopes, latex gloves, masks, neckties, pens, white coats, computers and accessories like keyboards have been associated with outbreaks of

HAI.¹ Stethoscope is an important instrument of medical professionals and is often used to assess the health of patients and single stethoscope is often used for all patients. Stethoscopes used by medical practitioners, students and health workers have been shown to be a potential vectors in the transmission of nosocomial infections in various part of the world. Furthermore disinfection of devices is not done as a routine.^{2,3}

Also antibiotic resistant microorganisms may be transmitted from one patient to another through medical devices.⁴ Though clinicians are instructed about bacterial colonization and the importance of maintaining clean

medical instruments, these devices may not be thought of a potential source of HAI.⁵ The use of 70% isopropyl alcohol is found to be effective in reducing contamination of stethoscopes and other medical equipments than other agents like detergents.⁶⁻⁸ Hence we intended to determine the level of contamination of stethoscope and to analyze the effectiveness of disinfectants, whether or not the degree of colonization would be reduced with the use of 70% isopropyl alcohol.

METHODS

It was a prospective, cross sectional study conducted at tertiary care teaching hospital for two months, 50 stethoscopes used by physicians, surgeons and students from all the wards after getting informed consent. The sample was collected by using sterile swab soaked in sterile saline.

The sampling was done from the diaphragm and rim of the stethoscopes. Then the stethoscopes was cleansed by 70% isopropyl alcohol and left for 5 minutes to act. The second sample was collected and both the swabs were

transported immediately to the laboratory. The sample was inoculated in blood agar and MacConkeys agar, incubated at 37°C for 48 hours. The growth was observed, colonies were counted and identification was done as per standard conventional methods.

The colony count ≥ 20 CFU/diaphragm was considered as significant contamination for Stethoscope.⁹ Drug resistance bacteria like MRSA and ESBL was detected by using Cefoxitin 30µg disc and double - disc synergy test respectively.

RESULTS

Out of the 50 stethoscopes, 30 (60%) stethoscopes were showing significant bacterial colonization, 7 (14%) stethoscopes showed insignificant colonization and no growth was seen in 13 (26%) stethoscopes.

All the samples (n=50) collected after cleaning with 70% isopropyl alcohol have shown no growth and become sterile.

Table 1: Type of bacteria isolated from Stethoscopes before and after decontamination.

Type of bacteria isolated	Before decontamination		After decontamination
	Number	Frequency	
MRSA	7	14%	NIL
MSSA	6	12%	NIL
CNS	7	14%	NIL
<i>Klebsiella pneumonia</i> (ESBL Producer)	4	8%	NIL
<i>Klebsiella pneumonia</i> (Non- ESBL)	3	6%	NIL
<i>Klebsiella oxytoca</i>	3	6%	NIL
Total	30	60%	NIL

Table 2: Distribution of growth pattern in different stethoscopes.

Stethoscopes used by different specialties	Total no of samples (n=50)	Significant growth	Insignificant growth	No growth
Physicians	15	10 (67%)	03	02
Surgeons	10	06 (60%)	02	02
OBG	5	05 (100%)	00	00
Interns	10	06 (60%)	02	02
Students	10	03 (30%)	0	07
Total	50	30 (60%)	07 (14%)	13 (26%)

The bacteria isolated from the Stethoscopes were viz: MRSA 7/50 (14%), MSSA 6/50 (12%), CNS 7/50 (14%), and Klebsiella species 10/50 (20%). Amongst the Klebsiella species 7/10 were klebsiella pneumoniae and 3/10 were Klebsiella oxytoca (Table 1). Mixed growth was observed in 10/30 (33%) stethoscopes, and pure growth of MRSA 5/30 (17%), MSSA 6/30 (20%), CNS 5/30 (17%), and Klebsiella pneumoniae 4/30 (13%) were

observed. Further than of 50 stethoscopes tested for bacterial colonization, the Stethoscopes used by different specialties were as follows: Physicians (n=15), Surgeons (n=10), Gynecologists (n=5), Interns (n=10) and students (2nd MBBS) (n=10) (Figure 1). The distribution of growth pattern in different professional stethoscopes is given in Table 2.

The highest rate of colonization was noted with stethoscopes used by Gynecologists (100%), followed by Physicians (67%), Surgeons (60%), Interns (60%) and students (30%).

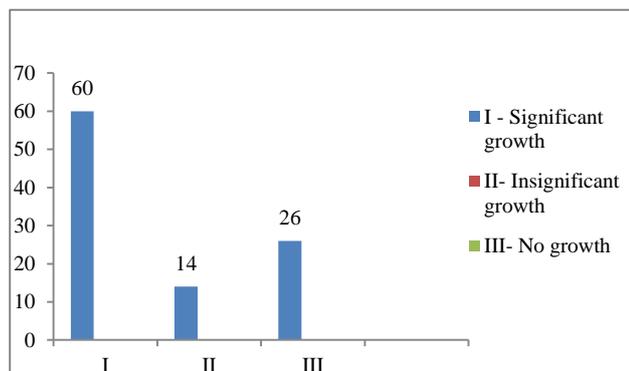


Figure 1: The rate of bacterial colonisation before decontamination.

DISCUSSION

The usage of medical devices for diagnosis and treatment has been contributed to the occurrence of HAIs worldwide. The HAIs lead the patient's poor diagnosis. The introduction of such devices is not wrong by itself instead facilitates deficit of the medical professionals but commitment deficit of the medical professionals to the infection prevention protocols was significant. In our study 30/50 (60%) stethoscopes were contaminated with different species of bacteria which is like the study conducted by Africa –Purino and his colleagues found 57% of bacterial contamination in the stethoscopes.¹⁰ But most of the previous studies showed higher rate of contamination viz: Zuliani – Mulufetal (87%), Youngster etal (85.7%), Unekeetal (80.1%) and 100% in the reports given by Marinellaetal and Wood et al.^{1,11-14}

In present study the usage among professionals are as follows: the Gynecologists(100%), by Physicians (67%), Surgeons & Interns (60%) were showing heavy contamination whereas the study conducted by Chigozie J etal, Marinellaetal and others had reported that only physicians were more contaminated and higher bacterial load than other health care workers and the fact that physicians use stethoscopes more frequently than other health workers explain the higher rate of bacterial colonization.^{13,15}

In present study Gynecologists stethoscopes (100%) had higher rate of contamination which explains the same. None of the gynecologists of our hospital have practice of cleaning in between patients. Many studies revealed that the drug resistant organisms like MRSA, VRE and ESBL have been isolated from the stethoscopes. This is comparable to present study as MRSA (14%) and ESBL (6%) were isolated and has been described as a serious public health concern. The bacterial species isolated were gram positive bacteria (40%) like MRSA (14%), MSSA

(12%), CNS (14%), whereas gram negative bacilli only one genus Klebsiella was isolated (20%) which is like the study conducted by Shiferaw T et al, where the gram positive cocci was isolated in more number of stethoscopes.¹⁶ 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 span is less than an hour.¹⁷

The striking feature of present study was that 20% of the stethoscopes were colonized by only one gram negative bacteria like Klebsiella pneumoniae (14%) and Klebsiella oxytoca (6%), which could be a potential pathogen causing outbreaks of serious infections. The maximum survival time of most HAI pathogenic organisms is about 2-18 hours on the diaphragm surface of stethoscopes and clinicians spend on average less than 15 minutes with each patient; it is likely that stethoscopes can serve as a vehicle for the spread of infections serially to the visiting patients in the hospital settings.¹⁷ We know from the past and current research that the stethoscopes of physicians, nurses, students are frequently contaminated with microorganisms. The importance of cleaning the stethoscopes with disinfectant was demonstrated in many studies.

The bacterial isolates was significantly reduced after they cleaned with isopropyl alcohol, sodium hypochlorite or benz alkonium chloride.¹³ Also 0-3% of healthcare providers cleaning their stethoscopes regularly and just 10% cleaning theirs when they were spoiled with blood or human secretions.^{7,12,13,18} This is in consistent with our study, none of the health care workers (0%) have practice of cleaning their stethoscopes and in our study cleaning with 70% isopropyl alcohol made all 50 stethoscopes (100%) sterile. Strategies to minimize the transmission of infection from stethoscopes have been proposed, viz; the use of disposable stethoscopes, use of a single - use silicone membrane over the stethoscope head, anti-microbial coating over the diaphragm.¹⁹

CONCLUSION

Present study confirmed that stethoscopes used by health care workers were contaminated with pathogenic as well as non-pathogenic microorganisms (skin flora) transmitted to next contact patients. The study also indicates an urgent need to alert and educate hospital staffs about the potential health risks associated with the medical devices. Hospitals should develop rigorous programs and protocols for disinfection of medical devices a standard for care. The strict adherence will minimize cross contamination and ensure improved patient safety in hospitals.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Uneke CJ, Ogbonna A, Oyibo PA, Ekuma U. Bacteriological assessment of stethoscopes used by medical students in Nigeria: Implications for nosocomial infection control. *World Health Popul.* 2008;10:53-61.
2. Whittington AM, Whitlow G, Hewson D, Thomas C, Brett SJ. Bacterial contamination of Stethoscopes on the intensive care unit. *Anaesthesia.* 2009;64:620-4.
3. Gopinath KG, Stanley S, Mathai E, Chandy GM. Pagers and Stethoscopes as vehicles of potential nosocomial pathogens in a tertiary care hospital in a developing country. *Trop Doct.* 2011;41(1):48-5.
4. Fenelon L, Holcroft L, Waters. "Contamination of stethoscopes with MRSA and current disinfection practices." *J Hosp Infect.* 2009;71(4):376-8.
5. Wilkins RL, Restrepo RD, Bourne KC, Daher N. Contamination level of stethoscopes used by physicians and physicians Assistants. *The J of Physician Assistant Edu.* 2007;18:41-3.
6. Alothman A, Bukhari A, Aljohani S, Muhanaa A. Should we recommend stethoscope disinfection before daily usage as an infection control rule? *Open Infect Dis J.* 2009;3(1):80-2.
7. Parmar RC, Valvi CC, Siva P, kamatJ. A prospective, randomized, double - blind study of comparative efficacy of immediate versus daily cleaning of stethoscope using 66% ethylalcohol. *Indian J Med Sci.* 2004;58(10):423-30.
8. Nolson J, Biven SA, Shinn A, Wanzer L, Kasper C. Microbial flora on operating room telephones. *AORN.* 2006;83(3):607-23.
9. Association Francaise de Normalisation Antiseptiqueset Desinfections, Paris La Defense. France AFNOR 1989.
10. Africa –Purino FMC, DYEER, Coronel RF. Stethoscopes:a potential source of nosocomial infections. *Phil J Microbiol Infect Dis.* 2000;29(2):9-13.
11. Zuliani Maluf ME, Maldonado AF, Bercial ME, Pedroso SA. Stethoscope: a friend or an enemy? *Sao Paulo Med J.* 2002;120:13-5.
12. Youngster I, Borkovitch M, Heyman E, Lazarovitch Z, Goldman M. The stethoscope as a vector of infectious diseases in the paediatric division. *ActaPaediatric.* 2008;97:1253-55.
13. Marinella MA, Pierson C, Chenoweth C. The Stethoscope- a potential source of nosocomial infection? *Arch Intern Med.* 1997;157:786-70.
14. Wood MW, Lund RC, Stevenson KB. Bacterial contamination of stethoscopes with antimicrobial diaphragm covers. *Am Med J Infect Contr.* 2007;35:263-6.
15. Chigozie JU, Annayo O Patrick GO, Christian MO. Bacteria contamination of stethoscopes used by health workers: public health implications. *J Infect DevCtries.* 2010;4(7):436-41.
16. Shiferaw T, Beyene G, Kassa T, Sewonet T. Bacterial contamination, bacteria profile and antimicrobial susceptibility pattern of isolates from stethoscopes at Jimma University Specialized Hospital. *Ann clinMicrobiol Antimicrobiol.* 2013;12:39.
17. Gastmeier P, Sehwab F, Barwolf S,Ruden H, Grundmann H. Correlation between the genetic diversity of nosocomial pathogens and their survival time in intensive care units. *J Hosp Infect.* 2006;6(22):181-6.
18. Saxena AK, Panhotra BR, AL-Mulhim AS. Contaminated physicians' stethoscope- a potential source of transmission of infection in the hospital. Need of frequent disinfection after use. *Saudi Med J* 2005;26:348-50.
19. Patentstorm. Disposable cover for stethoscope head 2004. Available: <http://www.freepatentsonline.com/574775/.html>.

Cite this article as: Jeyakumari D, Nagajothi S, Kumar PR, Ilayaperumal G, Vigneshwaran S. Bacterial colonization of stethoscope used in the tertiary care teaching hospital: a potential source of nosocomial infection. *Int J Res Med Sci* 2017;5: 142-5.