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A study on prevalence of bacterial contamination of stethoscopes used by health care workers (HCWs) in a tertiary care hospital

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ABSTRACT

Aim

The present study was aimed to determine the prevalence of bacterial contamination of stethoscopes used by health care workers (HCWs) in the tertiary care centers.

Materials and method

100 stethoscopes were randomly selected from the physicians and other health care workers. Swabs were taken from the stethoscopes by rubbing on the entire surface of the diaphragm. Then the collected swabs were inoculated on Nutrient agar, Blood agar and Mac-conkey agar plates. Standard methods were followed for isolation and identification. Antibiotic susceptibility testing was performed by Kirby-Bauer Disk diffusion method by Mueller Hinton agar as per CLSI guidelines.

Result

Out of 86 stethoscopes surveyed, 63 (73%) were evidenced with various micro organism and the remaining 23(27%) were found to have no growth.

Isolates included *Staphylococcus aureus* (19%), *Pseudomonas aeruginosa* (11.1%), *Enterococcus faecalis* (3.17%), and *Escherichia coli* (27%), *Streptococcus pyogenes*(16%), *Klebsiella pneumoniae*(16%), *Micrococcus spp*(6.3%),*Acinetobacter baumannii*(1.5%). *E.coli* was the highest prevalent organism and *Acinetobacter baumannii* was the least prevalent organism.

Conclusion

The present study depicts the prevalence of pathogenic microorganism on the stethoscopes capable of causing nosocomial infection. Our study highlights the need to disinfect the stethoscopes diaphragm to prevent any spread of bacteria from patient to patient. Strict adherence to disinfection of stethoscope by health care workers can minimize cross-contamination and ensure improved patient safety in hospital environments.

Keywords: Stethoscope, Bacteria, Nosocomial infections.

INTRODUCTION

Stethoscope is an essential tool for medical profession which is widely used by doctors and medical students for clinical examination of patients. Stethoscope comes in contact with numerous patients on day to day practices and their disinfection after each use must be followed by every physician. Because of their universal use, it might be a source of microorganism that causes nosocomial infection.

Stethoscope was first identified as the potential vectors for bacterial infection over 30 years ago. [1] During auscultation, stethoscope contamination is common, if the same stethoscope is used for the next patient without disinfection; it might bring risk of infection to the patient and may continuously impose the risk to all the patients. However they act as a vehicle for transfer of bacteria from one patient to another and contribute to nosocomial infections.

Stethoscopes are commonly used to assess the health of patients and have been reported to be potential vectors for nosocomial infections in various parts of the world. [2, 3, 4] Following contact with infected skin, pathogens can attach and establish themselves on the diaphragms of stethoscopes and subsequently can be transferred to other patients if the stethoscope is not disinfected. [5, 6]

There are increasing reports of risk of, transmission of antibiotic resistant microorganisms from one patient to another through stethoscopes. These antibiotic-resistant organisms are capable of initiating severe infections in a hospital environment and could require contact isolation and aggressive treatment to prevent the spread of the organisms. [7, 8]

Several studies in medical literature have demonstrated that many physicians' stethoscope are contaminated with pathogenic bacteria and could serve as a mode of transmission of infection [9, 10, 11] This phenomenon may be a particular problem in areas where outbreak of MRSA occurs or where patients with increased susceptibility to infections are known to be found.

Draping of stethoscope around the neck is still a commonly seen practice, resulting in the risk of contamination of the diaphragm of the stethoscope with normal flora and pathogenic bacterial strains from unhygienic ear pieces which will harbor the ears of the HCWs. The Diaphragm of the

stethoscope of HCWs has been implicated in harboring a variety of microorganisms. [12, 13]

Hence, this study was undertaken to find out the presence of bacteria and detection of the species isolated on the stethoscopes of physician and other HCWs. This study was intended to evaluate the problem by surveying the current practice of stethoscope hygiene among health care professionals.

MATERIALS AND METHOD

This study was conducted from January 2017 to March 2017 in tertiary care hospital, Chennai, for a period of 3 months for the examination of bacterial prevalence on stethoscopes.

Sample size and Sampling technique

Swabs were taken from 86 stethoscopes, which were used by different HCWs like clinicians, nurses and house surgeons for bacteriological examination.

Inclusion criteria

After obtaining informed consent from each HCW, testing their stethoscopes for bacteria was undertaken.

Exclusion criteria

HCW who did not consent were excluded from this study.

Specimen collection and identification of pathogen

After getting informed consent from each participant, Swabs were collected from entire surface of the diaphragm of the stethoscope by rubbing moistened sterile cotton swabs on it (0.9% physiological saline). The swabs were directly inoculated on Nutrient agar, Blood agar, Mac-Conkey agar. The contaminants were identified based on the colony morphology, hemolysis pattern and gram staining of the colonies. Further identification was done by biochemical reactions. Standard methods were followed for isolation and identification. [14]

Antimicrobial susceptibility testing

Antimicrobial susceptibility testing was carried out by Kirby-Bauer disk diffusion method as per clinical laboratory standards institute (CLSI) guidelines to study antibiotic susceptibility pattern. [15]

RESULT

Table: 1 BACTERIAL GROWTH IN STETHOSCOPE

BACTERIAL GROWTH	63	73%
NO GROWTH	23	27%
TOTAL	86	100%

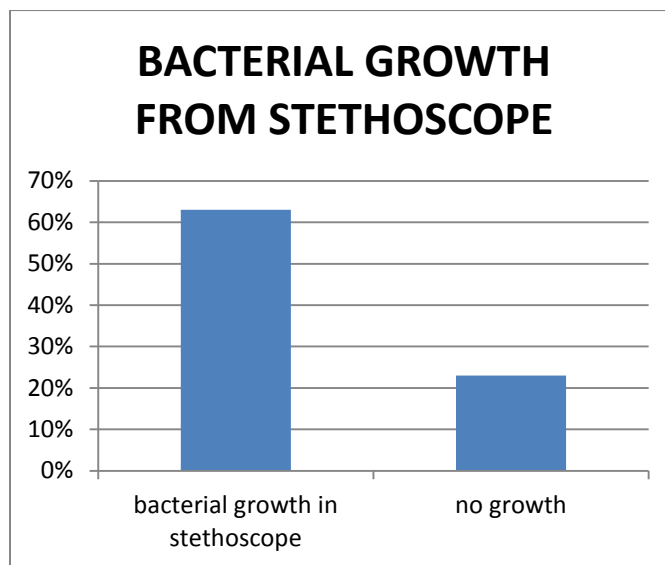


Fig: 1 DIAGRAMMATIC REPRESENTATION OF BACTERIAL GROWTH

Table: 2 PREVALANCE OF ISOLATES FROM STETHOSCOPE

S.no	Isolated organisms	Number of isolates	Percentage
1	<i>E.coli</i>	17	27%
2	<i>Staphylococcus aureus</i>	12	19%
3	<i>Streptococcus pyogenes</i>	10	16%
4	<i>Klebsiella pneumoniae</i>	10	16%
5	<i>Pseudomonas aeruginosa</i>	7	11.1%
7	<i>Micrococcus spp</i>	4	6.3%
6	<i>Enterococcus faecalis</i>	2	3.17%
8	<i>Acinetobacter baumannii</i>	1	1.5%

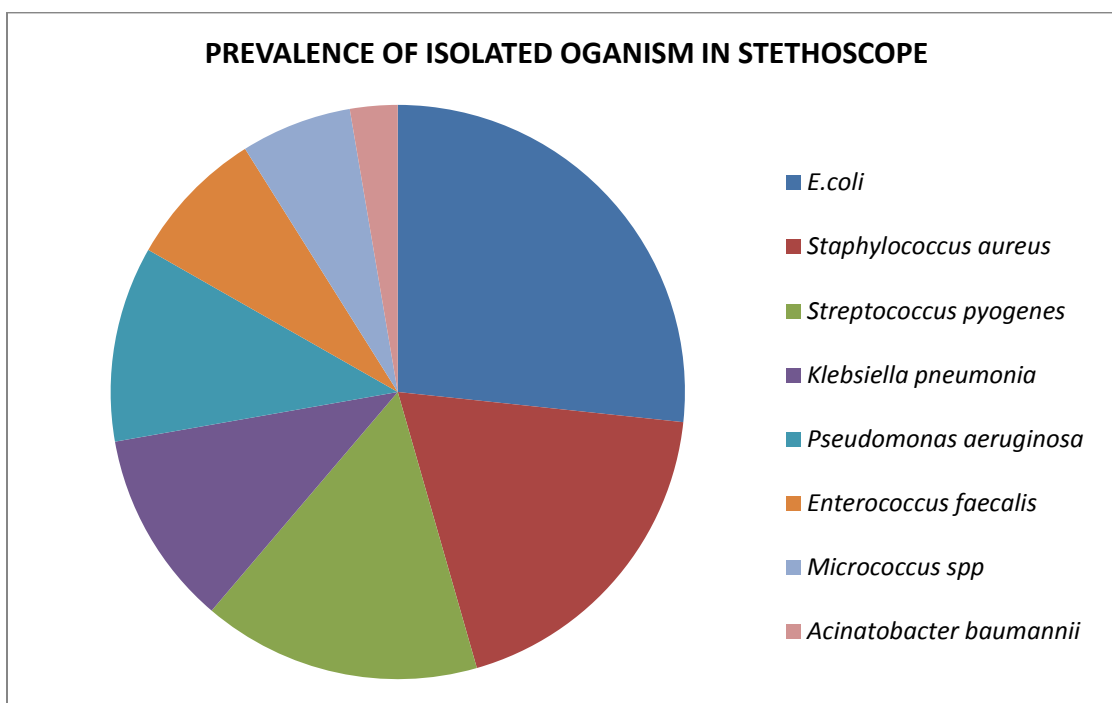


Fig: 2 DIAGRAMMATIC REPRESENTATION OF PREVALENCE OF ISOLATES FROM STETHOSCOPE

In this study, a total of 86 stethoscopes surveyed from HCWs for a period of about 3 months in Muthukumaran Medical College, Chennai. The swabs were taken from diaphragm of the stethoscope and the examination were done by proper microbiological procedure of culture technique like Nutrient agar, Blood agar, Mac Conkey agar, Chocolate agar and direct microscopy. Among 86 stethoscopes, 63(73%) showed bacterial growth with various micro organism and remaining 23 (27%) were implied to be no growth on culture technique as shown in the **Table: Fig: 1**. For all the bacterial identification, antimicrobial susceptibility testing were done by using routinely used antibiotics.

Table 2 and Fig 2 depicts the prevalence of bacteria in the diaphragm of the stethoscope which includes *Escherichia coli* (27%), followed by *Staphylococcus aureus* (19%), *Streptococcus pyogenes* (16%), *Klebsiella pneumoniae* (16%), *Pseudomonas aeruginosa* (11.1%), *Enterococcus faecalis* (3.17%), *Micrococcus spp* (6.3%) and *Acinetobacter baumannii* (1.5%) Among all the bacterial isolates, *Escherichia coli* was found to be the most predominant where as *Acinetobacter baumannii* shows least amount of bacterial contamination in the stethoscopes. In our results,

Gram negative bacterial isolation is comparatively more than Gram positive bacteria.

This study revealed the hygienic usage of stethoscopes by the health care workers, which facilitate to decrease the bacterial load significantly from the stethoscope, routinely minimize cross-contamination and also enhancing the patient safety in the hospital environment.

DISCUSSION

Health care workers (HCW) acts as a potential source of nosocomial infections. Since the time of Semmelweis, hand washing practice has been repeatedly shown to reduce the risk of nosocomial infections which are transmitted through hand carriage [16, 17] However, transmission of infection through medical devices is also well documented in our study.

In our research, from 86 samples, 63(73%) samples showed bacterial growth, remaining 23(27%) samples showed no growth. Stethoscopes which are utilized in clinical practice on a daily basis carry potentially pathogenic microorganisms like *Escherichia coli* (27%), *Staphylococcus aureus* (19%), *Streptococcus pyogenes* (16%), *Klebsiella pneumoniae* (16%), *Pseudomonas aeruginosa* (11.1%), *Enterococcus faecalis* (3.17%),

Micrococcus spp (6.3%), and *Acinetobacter baumannii*(1.5%).

Previous studies were consistent with the findings of this study, Teklu Shiferaw et al., who had reported 85.8% contamination, [18] Marienella et al., [19] and wood et al., reported 100% stethoscope contamination. (57%) of stethoscope contamination were reported by Africa Purino and his colleagues [20]

The result of this study reveals that 73% of the stethoscopes were contaminated with bacteria which is comparatively higher than the observations of previous study done by Huda A and his colleagues ⁽²¹⁾, who had reported 30% of contamination of stethoscopes by various bacteria.

Almost similar bacterial profile was observed in studies conducted by Soodp, mishra B et al., [22] who demonstrated (40%) of *Staphylococcus aureus*, 33% *E.coli* and 5% *Enterococcus faecalis* and Kuhu Pal et al., ⁽²³⁾ reported *Acinetobacter spp*17.11%, *Micrococcus Spp* 10.53%, *Staphylococcus aureus* 6.58%, *Pseudomonas spp* 6.58%, and *E.coli* 1.32% and Teklu shifaraw et al., [19] who had also proved *Klebsiella pneumonia* in 11.1%.

Jaballah N and Jroundi I et al., showed *Staphylococcus aureus* (59.3%) was the most common isolate over other potential pathogen isolated from the stethoscope,⁽²⁴⁾ Whereas in our study, the most prevalent organism is *E.coli* (27%) were isolated from the stethoscope contamination.

Acinetobacter baumannii was the least prevalent; this report was contrary to A. M. Whittington et al., who reported *Acinetobacter* as the most commonly isolated organism in the contaminated stethoscope. [5] *Streptococcus pyogenes* (16%) was isolated from stethoscopes in this study, whereas most other studies did not find any *Streptococcus* isolates.

In our study, the isolation of Gram negative bacteria are comparatively higher than Gram

positive bacteria, but contrarily a study done by Nelson j et al, who reported Gram positive bacteria are isolated more than Gram negative bacteria. [25]

There are increasing reports of the risk of transmitting antibiotic resistant microorganisms from one patient to another on stethoscopes. These antibiotic-resistant organisms are capable of initiating severe infections in a hospital environment and could require contact isolation and aggressive treatment to prevent the spread of the organisms, [26] although most of the organisms isolated in these studies were considered non-pathogenic.

CONCLUSION

In our study we conclude that utilization of stethoscope by health care workers are continuously contaminated with various microorganisms which could be transmitted to consecutive patients. Motivation of health care providers to convert their knowledge to habitual practice and recommendation of strict adherence to disinfection is implicated in our study, to prevent cross contamination and also to control the spread of drug resistant bacteria from patient to patient.

Significant reduction of bacterial load from the stethoscope can be attained by the usage of disinfectant, disposable stethoscope heads, use of stethoscope sterilizers and separate stethoscope for each bed.

Therefore, regular disinfection of stethoscopes should be recommended to minimize the possibility of spreading infectious agents in hospitalized patients.

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