

Stethoscope, A Unique Home of Staphylococcus Aureus in Hospitals

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ABSTRACT:

BACKGROUND

Nosocomial infections are hospital-acquired infections which are a leading cause of mortality and disability among patients admitted in hospitals. Microorganism colonization on the stethoscope's diaphragm is the main cause of disease spread. Stethoscopes are well known medical equipment fomites for Staphylococcus aureus and Methicillin-resistant Staphylococcus aureus (MRSA). The study was aimed to determine the frequency of Staphylococcus aureus present on diaphragms of stethoscopes in a tertiary care hospital, Islamabad.

METHODOLOGY

The descriptive cross-sectional study was performed at a tertiary care hospital in Islamabad. A consecutive non-probability sampling technique was used and the total sample size of 76 stethoscopes was calculated. Microbial samples were taken by rubbing on the whole diaphragm of the stethoscope. Later, the sample was incubated with a suitable growth medium for 48-72 hours at 36-37 °C temperature. Staphylococcus aureus appeared and these isolates were placed on agar plates with pre-impregnated antibiotics in different zones and incubated overnight and bacterial growth was observed. The species of staph. aureus which showed resistance to penicillin's and cephalosporin were known as methicillin-resis-

tant Staphylococcus aureus (MRSA).

RESULTS

Out of 76 samples, 34 (45.7%) samples had Staphylococcus aureus and the remaining 42 (55.3%) had no microorganism found. Furthermore, among 34 samples of S aureus, 28 (36.8%) were sensitive to antibiotics treatment and 6 (7.9%) showed resistance which was identified as Methicillin-resistant Staphylococcus aureus (MRSA). It has identified that there was a significant relation (p 0.05) between Methicillin-resistant Staphylococcus aureus and area of work.

CONCLUSION

Staphylococcus aureus and MRSA related nosocomial infections are some of the common causes of prolonging the stay of patients in the hospitals. Contaminated stethoscopes in hospital settings can transmit Staphylococcus aureus and MRSA in patients. Proper and frequent disinfection of stethoscopes prevents the cross-infection of Staphylococcus aureus and MRSA.

KEYWORDS

Nosocomial infections, Staphylococcus aureus, Methicillin-resistant Staphylococcus aureus (MRSA), Stethoscopes

INTRODUCTION

Nosocomial infections are healthcare-associated infections that patients acquire during their stay in hospitals. It is referred to as the occurrence of infection in the patients which are caused in the time frame of 48 hours after the admission to 30 days after the hospital stay.⁽¹⁾ It is not only the concern of patient safety in the healthcare setting but also a major factor leading to the transmission of drug-resistant antimicrobial agents. Nosocomial infection is one of the major and unwanted causes of prolonging the stay of patients in the hospital. Moreover, in devel-

oped countries, 7 out of 100 and in developing countries 10 out of 100 patients are at the risk to attain healthcare-associated infections. Nosocomial infection not only prolongs hospital stay of the patients, but they can also cause long term disability, amplify mortality rate, raise financial burden and increase resistance towards antibiotics.⁽²⁾ There are different types of healthcare-associated infections that are already highlighted by Nation Healthcare Safety Network in the manual of United States Centers for Disease Control and Prevention. The most common

healthcare-associated infections include methicillin-resistant *Staphylococcus aureus*, penicillin-resistant *Pneumococcal*, extended sputum beta-lactamase producing *Enterobacteriaceae* and carbapenem-resistant *Enterobacteriaceae*.⁽³⁾

Staphylococcus aureus is gram-positive cocci shaped bacteria and usually having a grape like structure. They can grow aerobically and anaerobically at the temperature of 18 to 40-degree centigrade. It is found in human mucus membranes and as normal flora on the skin and also in the surrounding environment. It is not responsible for causing an infection on healthy skin but getting entry into bloodstream and tissues can cause some serious health issues. It has been estimated that it has developed resistance toward antibiotics which has known as methicillin-resistant *Staphylococcus aureus*.⁽⁴⁾ Furthermore, in Pakistan and India nosocomial bacterial infections, methicillin-resistant *Staphylococcus aureus* (MRSA) has a much higher prevalence as compared to Northern Europe. In Pakistan, the prevalence rate of MRSA is 35-45 %.⁽⁵⁾ In hospital settings, medical equipment like stethoscopes, blood pressure measuring cuffs, electronic thermometers, latex gloves, masks, pens, and white coats are more prone to healthcare-associated infections. Among all healthcare equipment, the stethoscope is more frequent in use by healthcare workers which is the source cause of transmission of hospital-acquired infections. Microbial contaminations on stethoscope can cause hypercolonization of microorganisms. Thus, improper disinfectant techniques could cause a sabotaging effect on human health. It has been observed that due to the lack of adaptability of disinfectant techniques among healthcare workers were the main cause of spreading nosocomial infections. Microorganisms that commonly colonized on stethoscope include methicillin-resistant *Staphylococcus aureus*, ceftazidime-resistant *Klebsiella pneumonia*, vancomycin-resistance *Enterococcus*, ciprofloxin-resistant *Pseudomonas aeruginosa*, gentamycin-resistant *Pseudomonas aeruginosa*, and penicillin-resistant *Pneumococci*.⁽⁶⁾

This descriptive study design has helped to assess the prevalence of *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* on the diaphragm of stethoscope among nursing counters and doctors working in a tertiary care hospital of Islamabad, Pakistan.

METHODS

The descriptive cross-sectional study was performed at a tertiary care hospital in Islamabad. Consecutive non-probability sampling technique was used and the total sample size of 76 stethoscopes was calculated by using a 95% confidence level with a margin of error 5% & reported frequency of MRSA is 35.72%. Microbial samples were taken with the help of sterilized culture

sticks by rubbing on the whole diaphragm of the stethoscope and sent to the microbiology department of the hospital. Later, the sample was incubated with a suitable growth medium for 48-72 hours at 36-37 °C temperature. *Staphylococcus aureus* appeared with small, yellow, colonies on blood agar. These isolates were placed on agar plates with pre-impregnated antibiotics in different zones and incubated overnight and bacterial growth was observed. The zone around the antibiotic disc that has no growth was referred to as “zone of inhibition”.⁽⁷⁾ The species of *Staph. Aureus* which showed resistance to penicillin’s and cephalosporin were known as methicillin-resistant *Staphylococcus aureus* (MRSA).

RESULTS

The total sample size was 76 stethoscopes (N=76) which included 8 consultants (10.5%), 48 residents (63.2%), 7 house officers (9.2%) and 13 nursing counters (17.1%). Area of work included, 72.4% of stethoscopes were from medicine, 2.6% ICU, 5.3% CCU, 9.2% surgery, 3.9%

Variables	Frequency	%age	Mean	t-test	
			± Standard Deviation		
Profession	Consultants	8	10.5	2.3289	22.94
	Residents	48	63.2	± 0.88526	
	House Officers	7	9.2		
	Nursing Counters	13	17.1		
	Total	76	100		
Area of work	Medicine	55	72.4	2	9.364
	ICU	2	2.6	± 1.8619	
	CCU	4	5.3		
	Surgery	7	9.2		
	Obs. & gynae	3	3.9		
	Emergency	5	6.6		
	Total	76	100		

Table 01: Frequency of participant’s profession

obstructive and gynecology and 6.6% were from the emergency department (Table 01).

After 48-72 hrs of incubation with blood agar medium *Staphylococcus aureus* appeared. Out of 76 samples, 34 (45.7%) samples had *Staphylococcus aureus* and the remaining 42 (55.3%) had no microorganism found.

Furthermore, among 34 samples of *S aureus*, 28 (36.8%) were sensitive to antibiotics treatment and only 6 (7.9%) showed resistance which was identified as Methicillin-resistant *Staphylococcus aureus*. Mean and standard deviation among *Staphylococcus aureus* presence and absence

Isolates of Microorganisms		Freq uency	% age	M ± S.D	t-test	
Staphylococcus aureus	Presence	Sensitive	28	37	2.553	17.7
		Intermediate	0	0	± 0.501	
		Resistant	6	7.9		
	Absence	42	55			
	Total	76	100			

Table 02: Isolates of Staphylococcus aureus and their resistance toward antibiotics

calculated as 2.550.50 (Table 02).

Chi-square test with a significance value of $P \leq 0.05$ was conducted between Methicillin-resistant *Staphylococcus aureus* and the profession of participants and area of work. It has identified that there was a significant relation between Methicillin-resistant *Staphylococcus aureus* and area of work with $P=0.05$. On the other hand, there was no significant relation among Methicillin-resistant *Staphylococcus aureus* and the profession of participants with $P=0.102$. In figure 1, it has been identified that the surgery department has a frequency of 3, medicine has 2 and Obs. & Gynaecology has 1 for MRSA. On the other hand, all the *Staphylococcus aureus* found sensitive to antibiotic activity on them.

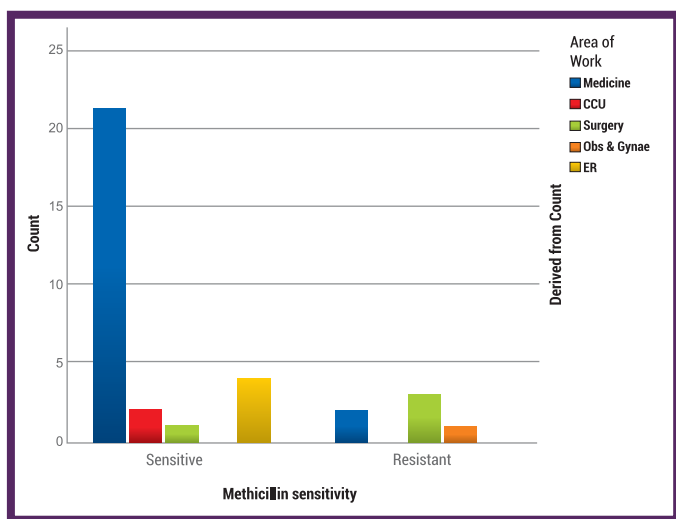


Figure 1: Cross-tabulation between MRSA and Area of work

DISCUSSION

The purpose of the study was to identify the current frequency of *Staphylococcus aureus* and MRSA colonization on diaphragm among healthcare professional's stethoscope at tertiary care hospitals in Islamabad. It has estimated that more than 1.4 million people were infected by Nosocomial infections worldwide.⁽⁸⁾ Transmission of infections during a stay at the hospital has become hazardous to both healthcare staff and patients. To overcome this problem public health measures have been taken worldwide such as handwashing, cleaning stethoscope diaphragms and other preventive methods. Stethoscopes are considered as a potential carrier for nosocomial infections.⁽⁹⁾

A study conducted in Ethiopian hospital showed that out of 176 numbers of stethoscopes 151 were contaminated with bacteria which was considered the highest rate of contamination.⁽¹⁰⁾ Another study conducted in Nigerian Hospital showed that out of 107 stethoscopes 84 of them were bacterially contaminated and the organism isolated was mostly *Staphylococcus aureus*. The rate of bacterial contamination was notably less as compared to our study in which out of 76 samples of *S aureus* 28 (36.8%) were sensitive to antibiotics treatment and only 6 (7.9%) showed resistance which was identified as Methicillin-resistant *Staphylococcus aureus*.⁽¹¹⁾

Furthermore, it is also identified in our study that MRSA was most commonly found in the surgery and medicine department. In contrast, a study conducted at Rajshahi Medical College Hospital of Bangladesh has shown that internal medicine and pediatrics have 17.7% MRSA found on their stethoscopes.⁽¹²⁾

The implication of the study findings showed that the stethoscope might be the main instrument that has a vital role in spreading nosocomial infections. In our study, the major microbial isolate is MRSA which should be under high concern. It has shown that stethoscopes might be responsible for the spread of nosocomial infections, but it has proved that improper cleaning practices of stethoscopes can be a leading cause of bacterial contamination.⁽¹³⁾ Even the minimum period of contacting a stethoscope with the skin of the patient has a potent effect in spreading infection.⁽¹⁴⁾ Cleaning practices of stethoscope's diaphragm using chlorhexidine, ethanol-based cleaner or isopropyl alcohol can help control bacterial contamination.⁽¹⁵⁾

The isolation of potentially pathogenic microorganisms suggests that the stethoscope must be considered as a potential vector of infection not only in the ED but also in other hospital wards and out-patient clinics. Also, special focus should be given to giving knowledge to all health care professionals about proper medical hygiene.⁽¹⁶⁾

CONCLUSION

Prevalence of *Staphylococcus aureus* and MRSA is quite common in the health care setups and stethoscopes are the possible vector of infections transmitted from one patient to another in the hospital settings. Disinfection of medical equipment especially stethoscopes can play a vital role in breaking the chain of nosocomial infections. Further studies are required to see the practices of the disinfection of stethoscopes among health care professionals.

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