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(RESEARCH ARTICLE)

Isolation and antibiotic susceptibility test of bacteria from healthcare workers and hospital environment

Ahmed, H. A. [1] * and Alkali I. Y [2]

[1] *Department of Pharmacognosy and Ethnomedicine, Faculty of Pharmaceutical Sciences, Usmanu Danfodiyo University, Sokoto.*
[2] *Department of Pharmacology and Therapeutics Usmanu Danfodiyo University Sokoto*

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Abstract

Hospital-acquired infections are one of the most significant adverse events for healthcare institutions increasing morbidity and mortality. The hospital environment is a potential source of infection especially with pathogenic bacteria. The study was aimed at identifying some possible sources of pyogenic bacterial infections in a Private hospital and determining the antibiotic susceptibility. Bacteriological analysis of swabs from hands of health care staff, the floors in the wards and clinics, beds and examination couches in the clinics and wards was carried out. Organisms were identified by Gram stain, catalase and coagulase test oxidase test. *Bacillus spp and Streptococcus spp* were isolated from the floor, bed and air. *Staphylococcus spp* was isolated from the hands of health workers. The organisms isolated were resistant to cloxacillin, amoxicillin, and streptomycin but susceptible to ofloxacin, gentamicin and co-trimoxazole. The findings in this study reveal that the hospital environment and the hands of healthcare workers can serve as a reservoir for antibiotic resistant microorganisms.

Keywords: Antibiotic susceptibility; *Bacillus spp*; *Staphylococcus spp*; *Streptococcus spp*

1. Introduction

Healthcare associated infections (HCAI) occur in a patient under medical care in the hospital or other healthcare facility which was absent at the time of admission. These infections occur during healthcare delivery for other diseases and may appear even after discharge of the patients [1]. Infections occurring more than 48 hours after admission are usually considered nosocomial. Hospital acquired infections (HAI) and health care associated infections (HCAI) also include occupational infections among health facility staff [2]. Healthcare-associated infections (HAIs) are a leading cause of morbidity and mortality worldwide. There is increasing difficulty in treatment of HAI due to antibiotic resistance among pathogens [3]. The hospital environment serves as reservoir for pathogens in the inanimate hospital surfaces. The contribution of the environment surfaces is so important. It has been reported that 10% hospitals acquire this infection while staying hospital [4]. Microbial contaminants have been reported to survive on dry surfaces including those commonly touched by healthcare staff and patients for prolong periods and serve as source of hand transfer of microorganisms known to cause infections [5]. The most common organisms that cause hospital acquired infections are *Klebsiella pneumonia, Staphylococcus aureus, and Pseudomonas spp* [2]. These infections significantly affect the resource needs of hospitalized patients. They increase the mortality and morbidity of affected individuals and expose hospital staff to increased risk of infection [6, 7]. Few data are available to assess whether an infection is hospital acquired or community acquired and Healthcare associated infections are not usually differentiated from community

*Corresponding author
E-mail address: aliyuhameedahmed@gmail.com

acquired infections. The aim of this study is to identify the sources of healthcare associated infections and carryout antibiotic susceptibility test of the isolated organisms.

2. Material and methods

2.1. Specimen collection

In this study, specimens were collected from a private hospital in Sokoto North western Nigeria. Swabs were taken from hands of health care staff (doctors and nurses) floors in the wards and clinics; and swabs from the beds and examination couches in the clinics and wards. It also includes the culturing of organisms from the air of the environment within the wards and clinics. A total of 15 swabs were taken and bacteriological analysis was carried out to identify the organisms.

2.2. Isolation of microorganisms

The samples were inoculated into Nutrient agar, Mueller Hilton agar, and Macconkey agar plates. The plates were incubated at 35 °C for 24 hours. Organisms were identified by Gram stain, catalase, coagulase test and oxidase test.

2.3. Antibiotic susceptibility test

The antibiotic susceptibility tests were carried out following modified disk agar diffusion procedures of Kirby-Bauer disc diffusion as recommended by the Clinical Laboratory Standard Institute (CLSI 2011) [8]. After incubation, the zones of inhibition were measured and compared with zone diameter illustrative chart to determine susceptibility of the isolates to antibiotics. Antibiotics used in this study include; ampicillin+cloxacillin (APX) (20 µg), amoxicillin (AMX) (25 µg), erythromycin (E) (30 µg), amoxicillin+clavulanic acid (AU) (30 µg), streptomycin (S) (30 µg), sulfamethoxazole+ trimethoprim (SXT) (30 µg), nalidixic acid (NA) (30 µg), chloramphenicol (CH) (30 µg), ofloxacin(OFL) (10 µg), gentamycin (G) (10 µg) and cloxacillin (C), (10 µg).

3. Results and discussion

The results from this study revealed the presence of *Bacillus spp, Streptococcus spp, and Staphylococcus spp* on the various surfaces in the hospital environment. The bacilli spp isolated from the floor and air were Gram negative bacilli spp. The study by Ige et al., 2011 [9] showed that Gram negative bacilli are the major cause of nosocomial infections. *Staphylococcus spp* was isolated from the hands of health workers this agrees with the study of Ikeh et al., 2011 [10].

Table 1 Some sources of bacterial pathogens and susceptibility pattern of the isolated organisms to various antibiotics

Source	Isolate	ST	T	C	COT	G	CXC	E	AUG	OFL	AMX	NAL	N
Floor 1	*Bacillus spp*	R	R	R	S	S	R	R	S	S	R	R	S
Floor 2	*Bacillus spp*	R	R	R	S	S	R	R	S	S	R	R	S
Floor 3	*Bacillus spp*	R	S	R	S	S	R	R	R	S	R	R	S
Air 1	*Bacillus spp*	R	S	R	S	S	R	R	R	S	R	R	S
Air 2	*Bacillus spp*	R	R	R	S	S	R	R	R	S	R	R	S
Air 3	*Bacillus spp*	R	S	R	S	S	R	R	R	S	R	R	S
Air 4	*Bacillus spp*	R	R	R	S	S	R	R	R	S	R	R	S
Bed 1	*Staphylococcus spp*	R	S	R	S	S	R	R	S	S	R	S	R
Bed 2	*Staphylococcus spp*	R	S	R	S	S	R	R	S	S	R	S	R
Bed 3	*Streptococcus spp*	R	S	R	S	S	R	R	S	S	R	S	R
Hand 1	*Staphylococcus spp*	R	R	R	S	S	R	R	S	S	R	S	R
Hand 2	*Staphylococcus spp*	R	R	R	S	S	R	R	R	S	R	R	R
Hand 3	*Staphylococcus spp*	R	R	R	S	S	R	R	R	S	R	R	R
Hand 4	*Staphylococcus spp*	R	R	R	S	S	R	R	R	S	R	R	R
Hand 5	*Staphylococcus spp*	R	R	R	S	S	R	R	R	S	R	R	R

Key: S=sensitive; R=resistant; ST=Streptomycin; T= Tetracycline; C= Chloramphenicol; COT; Co-trimoxazole; G=Gentamicin; CXC= Cloxacillin, E= Erythromycin; AUG= Augmentin; OFL=Ofloxacin; AMX= Amoxicillin; NAL=Nalidixic acid; N= Nitrofurantoin

The extent of colonization by Bacillus spp could be explained by the fact that *Bacillus spp a*re ubiquitous in nature and their spores are able to resist environmental changes, withstand dry heat and certain chemical disinfectants for moderate periods [10].

Organisms isolated include: *Staphylococcus spp, Streptococcus spp, Bacillus spp*. The various sources of infections and results of the susceptibility pattern of the isolated organisms are shown in Table 1. The organisms isolated were resistant to cloxacillin, amoxicillin, and streptomycin but susceptible to ofloxacin, gentamicin and co-trimoxazole.

Table 2 Isolation pattern of organisms

Organisms	Frequency	Percentage
Bacillus spp	7	46.7
Streptococcus spp	1	6.6
Staphylococcus spp	7	46.7
Total	15	100

4. Conclusion

In this study, potential sources of Hospital acquired infections were identified from the beds, hands, floor and air in the hospital and hands of healthcare workers. The organisms isolated include *Bacillus spp, Staphylococcus spp* and *Streptococcus spp* which were found to be resistant to cloxacillin, amoxicillin, and streptomycin but susceptible to ofloxacin, gentamicin and co-trimoxazole. According to the findings in this study, there is a need for adequate cleaning of the hospital environment to prevent transmission of healthcare associated infections.

Compliance with ethical standards

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Disclosure of conflict of interest

Both authors declare that there is no conflict of interest.

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