

# Stethoscope; - A Potensial Nosocomial Agent - A Clinicomicrobiological Study

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**Abstract:** Nosocomial infection has significantly influenced the quality of health care and has emerged as a leading cause of morbidity, mortality and increased health care cost. Medical equipments of non - critical care settings notably stethoscope plays a pivotal role in transmission of nosocomial agents owing to its universal use and lack of established disinfection practices. 200 stethoscopes from various sections of the hospital were sampled and 128 organisms were isolated. CoNS was the most common isolate followed by *Klebsiella pneumoniae*. Culture of stethoscopes following disinfection with 70% ethyl alcohol demonstrated reduced colonial growth.

**Keywords:** HAI, stethoscopes, disinfection

## 1. Introduction

The emergence of nosocomial infection has significantly impacted the health care quality. The health care workers, the hospital environment and lack of adherence to standard infection control practices have made significant contributions for this emergence and have routed to augmented rates of morbidity and mortality. The awareness among the healthcare workers regarding higher rates of infections among debilitated patients has prompted significantly greater emphasis on disinfection practices in critical care settings as compared to non - critical settings. Thus transmission of infection by medical equipments used in the non - critical care setting is more likely. Outbreaks of nosocomial infections attributed to various equipments of non - critical care settings such as electronic thermometers,<sup>1</sup> blood pressure cuffs,<sup>2</sup> latex gloves<sup>3</sup> and stethoscopes<sup>4 - 6</sup> have been reported.

Stethoscopes owing to its universal use pose a potential threat for transmission of agents of nosocomial infection. The dissemination of micro - organism among different patients is hugely precipitated by multiple patient contact and unestablished disinfection practices after each use

Lack of adherence to regular disinfection practices has been reported to cause the contamination of stethoscope particularly the diaphragm. This in turn has culminated into high risk of transmission of multidrug antibiotic resistant microorganisms in the hospital settings

Periodic surveillance of medical equipments and hospital environments may help in identifying potential bacterial pathogens and associated factors and indicate the necessity of intervention of appropriate control measures. Hence we intended to determine the level of bacterial contamination of stethoscopes using in present hospital

## Aims & Objectives

The study is aimed to find out the contamination rate of stethoscopes, antimicrobial resistance pattern of the

nosocomial agents and determine the efficacy of 70% alcohol as cleaning agent.

## 2. Materials and Methods

This prospective hospital based Study was carried out in a tertiary care hospital in South Assam for a period of 1 year (January 2021 - December 2021). 200 healthcare staff working in different sections of the hospital were randomly selected and were asked to fill up a simple self - explanatory questionnaire exploring the awareness about nosocomial infections, stethoscope's potential role in transmission and frequency of disinfection of their stethoscopes and all 200 stethoscopes were sampled. Samples from diaphragm and bell of stethoscopes were collected by swab moistened with saline and will transported immediately to Microbiology laboratory without delay. On receipt the samples were subjected to direct smear microscopy which was followed by inoculation in different media at 37°C for 48hrs. One of each uninoculated plate was incubated with these as a quality control. The colonial growth was subjected to Gram staining and biochemical identification

Antimicrobial susceptibility testing was performed on Muller - Hinton Agar using disc diffusion techniques according to Clinical and Laboratory Standards Institute (CLSI) guidelines. QC was done as per CLSI guidelines and ATCC strains. In addition, randomly 50 stethoscopes of clinicians and nurses were swabbed once with 70% ethanol, allowed to dry, and then sampled.

## 3. Results

Stethoscopes of 200 health professionals from different hospital wards and intensive care units (ICUs) were included in the study. The pie diagram shown in gives the department wise distribution of stethoscopes included in the study.

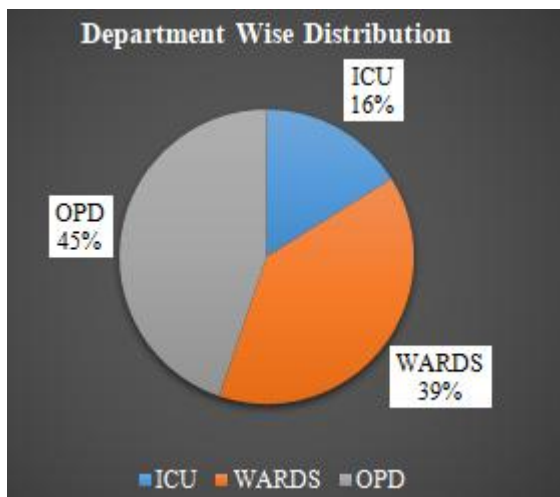


Figure 1

Parameter	Number of stethoscopes
Total number of stethoscopes studied	200
Number of stethoscopes showing bacterial and fungal growth	128
Number of stethoscopes showing no growth / not significant growth	92

Figure 2

One hundred twenty eight organisms were identified from 200 stethoscopes. Coagulase - negative staphylococci (CoNS) were the predominant isolates [76 (60%)]. The rest were *Klebsiella pneumoniae* [22 (17%)], *Acinetobacter species* [10 (8%)], *Staphylococcus aureus* [9 (7%)], *Bacillus species* [8 (6%)], and *Pseudomonas aeruginosa* [3 (2%)]. Figure 3 demonstrates distribution of isolated organism.

After 48 h of incubation, the bacterial load varied from one stethoscope to the other. The average number of colonies per stethoscope was 30, with a minimum number of 10 colonies from a stethoscope sampled from the Anaesthesia Department and a maximum number of 80 colonies seen from medicine ward

Out of 200 stethoscopes included in the study, 93 showed no growth and 128 showed growth demonstrating an overall contamination rate of 64%.

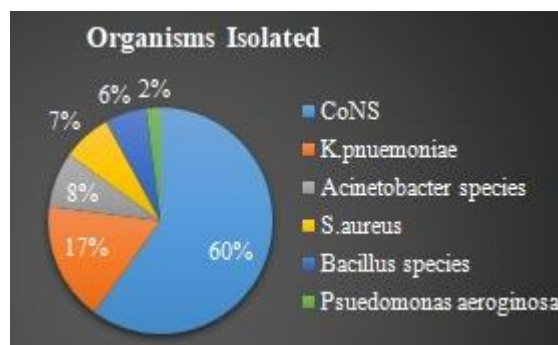


Figure 3

Antimicrobial Susceptibility of Gram Positive Bacteria

(Figure 4)

Bacterial Species	Total Isolate	Pattern	AMC	CX	COT	E	CD	GEN	LZ
CoNS	76	S	24	60	40	24	44	66	76
		R	52	16	36	52	32	10	0
<i>S. aureus</i>	9	S	0	1	9	6	8	7	9
		R	9	8	0	3	1	2	0

[Figure 4] shows the antibiotic susceptibility percentages of Gram positive bacteria. From the 76 isolated CoNS species, 52 (68%) were resistant to amoxicillin and erythromycin.

Maximum strains were sensitive to cefoxitin [60 (79%)]. However majority of *S. aureus* [8 (89%) ] were resistant to cefoxitin

Antimicrobial Susceptibility of Gram Negative Bacteria

(Figure 5)

Bacterial Species	Total No. Isolates	Pattern	AMC	CIP	CPM	CTR	PIT	MRP	CL
<i>Klebsiella pneumoniae</i>	22	S	20	9	18	16	13	20	22
		R	02	11	04	06	09	02	00
<i>Acinetobacter species</i>	10	S	00	06	04	04	08	09	10
		R	10	04	06	06	02	01	00
<i>Pseudomonas species</i>	03	S	00	01	03	01	02	02	03
		R	03	02	00	02	01	01	00

Figure 4 shows susceptibility profile of gram negative bacteria. Majority were sensitive to meropenem, piperacillin - tazobactam and cefipime. All isolates were susceptible to colistin. Resistance was noted in majority against amoxicillin - clavulonate, ciprofloxacin and amikacin.

showed colonization with growth of decreased number of colonies (3 - 5), thus demonstrating the effectiveness of cleaning

The stethoscopes were also subjected to cleaning with 70% ethanol which demonstrated a significant decrease in the bacterial count. Out of 50 randomly cleaned stethoscopes, 12

No. of Stethoscopes Samples	Culture Positive Stethoscopes Before Disinfection	Culture Positive Stethoscopes after Disinfection
200	128	12

#### 4. Discussion

Health care workers are a potential source of nosocomial infections and transmission of infection through medical devices is also well documented.

The results of our study demonstrate that stethoscopes that are utilized in clinical practice on a daily basis carry potentially pathogenic microorganisms. The frequency of contamination of stethoscopes observed in this study is 64% with CoNS (60%) as the predominant species followed by *Klebsiella pneumoniae* (17%).

Studies have reported similar contamination rate 70% to 100% in the literature.<sup>4-6</sup> However a lower contamination rate of 30% was observed by Bukhari et al.<sup>7</sup>

Disinfection with ethanol also demonstrated reduced contamination rate

#### 5. Conclusion

Our study confirmed that stethoscopes used by healthcare workers were contaminated with pathogenic as well as non-pathogenic microorganisms which could serve as a nidus of infection to the patients; therefore in order to reduce cross contamination and to provide a safe environment to the patients strict adherence to disinfection practices by health workers is highly recommended.

Some of the measures to prevent cross-contamination would be: Use of 70% ethanol as a disinfectant, disposable stethoscope heads, use of stethoscope sterilizers, and separate stethoscope for each bed. Although these strategies could minimize the risk of stethoscope transmission of infections, they are unaffordable to most health workers and health facilities in developing countries. The healthcare facilities should rather develop more stringent programs and protocols for stethoscope disinfection as a standard of care.

Future research could also focus on designing stethoscopes so as to facilitate decontamination and on the ways for effective and practicable means of decontamination.

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