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Contaminated Stethoscopes: A Potential Source of Nosocomial Infections[1,2]

RICHARD J. MANGI, M.D. and VINCENT T. ANDRIOLE, M.D.

Department of Internal Medicine, Yale University School of Medicine, New Haven, Connecticut 06510

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INTRODUCTION

The development of infection during hospitalization is a significant problem encountered daily on every hospital ward. The reported incidence of nosocomial infections is between 3.5 and 15.5% of all hospitalized patients(1–6).

Respiratory tract infections, urinary tract infections and postoperative wound infections are the major types of nosocomial infections(2–5). The predominant organisms responsible for these infections are coagulase-positive staphylococci and gram-negative bacteria, particularly *Pseudomonas aeruginosa, Escherichia coli, Klebsiella, Serratia,* and *Enterobacter*(1–4,7–12).

The natural history of the development of nosocomial infections appears to begin with exposure of patients to pathogenic bacteria which have colonized hospital equipment or the skin and nasopharynx of hospital personnel. From this exposure some patients will develop skin, mucous membrane or intestinal colonization with these bacteria(9,12–15). Those patients with lowered host defense mechanisms, with open wounds or who have undergone surgical manipulation may then develop clinical infection with these organisms by "autoinocculation"(3,9,16).

The purpose of the present study was to evaluate stethoscopes used by hospital personnel as a potential source of pathogenic bacteria which might be responsible for bacterial spread to, and colonization of, hospital patients.

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[2] Reprint requests should be addressed to Dr. Mangi.

METHODS

The study was designed to sample the bacterial flora present on stethoscopes of various groups of hospital personnel, which might be easily inoculated onto the skin of a patient during routine physical examinations or blood pressure measurements. All personnel participating in the study were working at the Yale–New Haven Hospital, a large university medical center.

Ten stethoscopes from each of the following groups were sampled: (1) medical interns, (2) medical residents or clinical fellows, (3) faculty actively engaged in patient care, (4) nurses stationed in the medical and surgical intensive care units, and (5) nurses working on the medical service wards. Each stethoscope was sampled once at a random time at least 10 min after its last use. In addition, 10 stethoscopes of medical interns and residents were swabbed once with a commercial 70% isopropyl alcohol sponge (Prep Swab[3]), allowed to dry and then sampled.

The diaphragm and bell sections of each stethoscope were pressed firmly one time onto a blood agar plate. The blood agar plates were then incubated aerobically at 37°C for 48 hr. The bacterial colonies were then counted and representative samples of each different type of colony present were subcultured and identified according to the scheme of Schaub, Foley, Scott and Bailey. Antibiotic sensitivity to penicillin was determined on all pathogenic Staphylococcal isolates by the single-disk method.

RESULTS

One hundred and twenty-five different organisms were isolated from 50 different stethoscopes (Table 1). Fifteen of these organisms (*S. aureus* and gram-negative bacilli) were classified as potential pathogens.

At least one bacterial species was cultured from 49 of the 50 stethoscopes sampled. Thirteen of 50 stethoscopes (26%) were contaminated with at least one potential pathogen.

The number of colonies present seemed to vary with the duties of the owner of the stethoscope and were highest in the intern group, intermediate in the resident and faculty group and lowest in the two nurse groups.

The 10 stethoscopes swabbed with 70% alcohol yielded only three different organisms, had a significantly lower colony count (0.8 vs 47.7/stethoscope), and contained no pathogenic bacteria (Table 2).

DISCUSSION

Nosocomial infections are a significant problem in every hospital and constitute a major threat to certain categories of patients. While postoperative

[3] Litton Medical Products.

patients traditionally have the highest infection rate, recipients of organ transplants and patients receiving chemotherapy are at an even greater risk(17–20).

The etiology of these infections appears to be a combination of lowered host resistance to infection, overzealous use of broad spectrum antibiotics, surgical manipulation and patient exposure to virulent strains of pathogenic baterial(9,12, 14,17,21,22).

Epidemiologic investigation of this problem has focused on the manner of spread of pathogenic bacteria in the hospital and the mode of subsequent development of clinically significant infection. There are reports of spread of infection by nasal carriers, dirty hands(23,24), inhalation therapy equipment(25,26), intravenous catheters(27,28), and contaminated intravenous solutions(29). Once infected with pathogenic bacteria, host defense mechanisms appear important in the subsequent development of colonization or disease(6,13,14,18,22). A large percentage of patients become asymptomatic carriers of potential pathogens,

TABLE 1
ORGANISMS ISOLATED FROM 50 STETHOSCOPES

Nonpathogens (130)[a]		Potential pathogens (15)	
Staphylococcus epidermidis	103	*Staphylococcus aureus*[b]	6
Diphtheroid species	10	*Escherichia coli*	2
Bacillus species	9	*Erwinia*	1
Alpha Streptococcus	5	*Serratia*	1
Molds	2	*Klebsiella*	1
Streptomycetes	1	*Proteus vulgaris*	1
		Enterobacter A	1
		Enterobacter B	1
		Pseudomonas aeruginosa	1

[a] Nonpathogens—may be pathogenic in an immunosuppressed host.
[b] *Staphylococcus aureus*—all isolates penicillin resistant.

TABLE 2
BACTERIA ISOLATED FROM DIFFERENT GROUPS OF HOSPITAL PERSONNEL

	Interns	Residents fellows	Faculty	ICU nurses	Ward nurses	Total	Stethoscopes swabbed with 70% alcohol
Stethoscopes with bacteria							
Stethoscopes sampled	10/10	10/10	10/10	9/10	10/10	49/50	3/10
Stethoscopes with potential pathogenic bacteria							
Stethoscopes sampled	2/10	5/10	1/10	3/10	2/10	13/50[a]	0/10
Average colonies[b]							
Stethoscope	81	55	64	19	19	48	0.8
Different bacteria[c]							
Stethoscope	2.8	3.3	3.3	2.9	2.2	2.9	0.3

[a] Two stethoscopes contained two different potential pathogenic organisms.
[b] Range (0–200) colonies/stethoscope.
[c] Range (1–6) different organisms/stethoscope.

with colonization of the skin, mucous membranes, or the gastrointestinal tract(9, 12). This fact assumes significance in view of the observation that the majority of nosocomial infections arise from organisms with which the patient is already colonized(9,15). Thus, contact with pathogenic bacteria may lead to an asymptomatic carrier state which, in turn, may lead to later clinical infection or may perpetuate the large host reservoir of pathogenic bacteria which contributes to infection of other patients and contamination of hospital equipment.

This report focuses on a previously unrecognized source of spread of pathogenic bacteria and, through the mechanisms outlined above, a potential cause of clinically significant nosocomial infections.[4]

The finding that about one quarter of hospital stethoscopes are contaminated with either penicillin-resistant *S. aureus* or gram-negative coliform bacteria, indicated that almost every patient who is examined daily by a few different physicians and nurses will be exposed to these organisms. The percentage of patients thus colonized with these bacteria is, at this time, impossible to estimate, but is probably significant.

The significant decline in bacterial colony count following simple swabbing of the head of a stethoscope with 70% alcohol indicates a solution to this potential danger. It is interesting to note that of the 60 physicians and nurses who participated in this study, only three had ever cleaned their stethoscopes, and none did so routinely before or after each patient examination. Such procedure should probably be routine for at least certain patients of high risk, such as those undergoing surgery or those on hemodialysis, and those receiving immunosuppressive or cytotoxic chemotherapy.

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[4] Since the completion of this study, a similar report has been published(30).

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