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REPRINTS

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Bacteriologic Studies on Electronic Hospital Thermometers

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ABSTRACT

Electronic thermometers used in many hospitals require insertion into the mouth of a temperature-sensing probe covered by a pre-packaged probe cover. Handling procedures used by hospital personnel can lead to inadvertent manual contact with the probe cover. We attempted to determine the rate of non-sterility of these probe covers under normal hospital conditions and the extent to which pathogens could be detected on these and other components of the thermometer. Probe covers were removed before entry into the patient's mouth and aseptically inoculated into fluid thioglycollate medium. Subcultures were made to appropriate differential media. Over a 13-week period, 180 covers were cultured on two private hospital services. Forty-three percent were found to be non-sterile; control covers from central supply were only 6% non-sterile. Four percent of the probe covers harbored potential pathogens: coagulase positive *Staphylococcus aureus*, *Streptococcus pyogenes*, *Enterobacter*, and *Bacteroides*. No attempt was made to correlate these findings with infection. These results indicated a potential infection hazard for high-risk patient groups and a need by hospital personnel to consider this as a possible source of contamination. [*Infect Control* 1981; 2(4):315-6.]

INTRODUCTION

Historically it has been the role of infection control practitioners to identify actual or potential sites of nosocomial infection transmission, whether from personnel or from inanimate objects. We have noted the increase in plastic devices and articles made available to the physician since the perfection of ethylene oxide and cobalt-60 sterilization procedures. Concurrent advances in electronic solid state technology have merged the concepts of "quick" and "disposable" into a single instrument, the electronic thermometer. This instrument, with its disposable probe cover, facilitates quick consecutive patient

temperature measurement with a single device. At the same time, it attempts to shield the next patient from cross-contamination.

We thought that it would be of interest to perform a bacteriologic study of these thermometers and their probe covers to develop some objective data about whether ward-to-ward and/or patient-to-patient contamination could occur. Our study covered two private hospital services where electronic thermometer systems were used.

METHODS

Test Site and Sampling Procedure

The investigation was conducted on two private hospital services at Saint Michael's Medical Center, Newark, New Jersey, during the period March 1979 to January 1980. None of the patients was in isolation. Temperatures were taken employing an electronic thermometer.* Nursing personnel were interrupted briefly by laboratory technicians, who cultured the last probe in each box of 10 disposable probe covers. At the end of each nursing tour, the thermometer case and the electronic thermometer probe on the cases in use at the time of testing were swabbed. In addition, cultures were taken from probe covers from unopened boxes in central supply, such as might be used on patients in isolation.

Bacteriologic cultures. Covers were removed from the probes before they were inserted into a patient's mouth, and were transferred aseptically to 20 mm test tubes containing 20 ml modified fluid thioglycollate medium (FTM). The FTM had been modified by the addition of 0.2% agar to form a semi-solid medium that would prevent immersion of the probe covers. Thus, when the cover was stabbed into the medium, only the portion that came into contact with the buccal tissue was cultured. Swabs from the case and probe components of the unit also were stabbed into tubes of semi-solid FTM.

All cultures were incubated at 35 C up to seven days. When growth appeared, subcultures were streaked to

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blood, mannitol-salt, and MacConkey's agar, and incubated aerobically and anaerobically at 35 C. Gram stains were performed on 24-hour subcultures; catalase, B-galactosidase and other physiologic tests were performed as necessary, according to standard methods. Gram-negative rods were speciated by means of the API-20 system, according to ASM guidelines.¹

RESULTS

Results obtained from culturing the central supply and the in-use probe covers are shown in Table 1. The plastic disposable probe covers from Central Supply displayed a non-sterile rate of 6%; in all cases the isolates were *Staphylococcus epidermidis*. The manufacturer does not claim that the disposable probe covers are sterile, and the non-sterile rate detected would suggest a relatively low bioburden. However, once the probe covers were opened and used on the wards, there was a large increase in the non-sterile rate.

The bacteria harbored on the contaminated probe covers were analyzed; these data are summarized in Table 2. We attempted to determine the distribution of pathogens on other components of electronic thermometers, namely the hand-held probe that enters the mouth, and the case that registers the digital display. The probes and the cases showed the presence of pathogens in 10/40 (25%) and 7/40 (18%) of the tests, respectively. Organisms encountered were the same as those listed in Table 2, as well as *Acinetobacter*, *Candida spp.*, and *Bordetella bronchiseptica*. All of the probes and cases cultured harbored non-pathogens such as *Staphylococcus epidermidis*, diphtheroid organisms, various members of the genus *Bacillus*, and certain filamentous fungi.

DISCUSSION

General recognition of a potential problem,² is the only kind of information that has been published on the contamination of disposable thermometer covers. The data presented here show a variable rate of nonsterility for the

TABLE 1

STERILITY TESTS ON ELECTRONIC THERMOMETER PROBE COVERS

Source	# tested	# contaminated	%
Central supply	50	3	6.0
In-use from ward	180	78	43.0

TABLE 2

APPEARANCE OF POTENTIALLY PATHOGENIC BACTERIA ON NON-STERILE THERMOMETER PROBE COVERS FROM TWO HOSPITAL WARDS

Parameter	# with pathogens
Total Tested	78 (100%)
<i>Enterobacter agglomerans</i>	2
<i>Clostridium perfringens</i>	1
<i>Staphylococcus aureus</i> (coagulase pos.)	2*
<i>Streptococcus pyogenes</i>	1
<i>Bacteroides</i>	1
	<hr/> 7 (4%) <hr/>

*One strain was penicillin-sensitive and one strain was penicillin-resistant, by the Kirby-Bauer technique

various components of the electronic thermometer studied, ranging from 43% to 100%. The types of pathogens isolated were fairly constant and consisted of representative gram-positive cocci, gram-negative rods, obligate anaerobes and a yeast. The pathogenic organisms isolated from the electronic thermometer components were the types associated with the dermal, nasal, and enteric flora of the human, and undoubtedly were inoculated onto the devices by nursing personnel.

Unopened probe covers harbored low levels of microbial source of infection. Probe covers became contaminated while in use, however, and were potential carriers of inf-while in use, however, and were potential carriers of infectious disease organisms. These organisms would seem to have originated from: (a) the accidental handling of the probe covers, and (b) contamination by the probes.

The electronic thermometer cases and the probes to which they were attached harbored large percentages of both virulent and non-virulent microorganisms. These components, therefore, represented potential sources of patient-to-patient or room-to-room cross-contamination. Furthermore, although the appearance of the non-virulent organisms was of no immediate health significance, their detection did tend to bring into perspective the need for environmental quality controls in the hospital with regard to human, fomite, and airborne contamination.

REFERENCES

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