Electrocardiography Wires: A Potential Source of Infection

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Learning Objectives
At the end of this learning activity, the participant will be able to:

1. Discuss 3 factors relating to the significance of the risk of nosocomial infections.
2. Describe the evidence linking reusable electrocardiography wires to the risk of nosocomial infections.
3. Identify initial steps for converting your facility to disposable electrocardiography lead wires.

As we face the increasing threat of microbial pathogens that have developed drug resistance in what some describe as pandemic proportions, we must give serious consideration to any means of controlling and eradicating these microbes. All possible avenues must be explored in order to gain a greater understanding of the problems and formulate a reasonable plan to solve them. No pathway of infection can be ignored in the fight to eliminate the root causes.

Nosocomial Infection Problems
Hospital-acquired nosocomial infections are a costly and important health risk, not only to critically ill patients but to the general population of patients as well. Infections originating in hospitals carry a 4.3% attributable mortality rate and extend hospital length of stay by a mean of 9.5 days. The mean cost of the excess charges associated with a hospital-acquired infection is $38,656, and these infections account for 90,000 deaths as well as $5 billion to $10 billion of economic liability annually.1

The frequency of hospital-acquired infections increased 22.5% from 2000 to 2003, according to the HealthGrades Second Annual Patient Safety in American Hospitals Report. This report contains a list of the “best-performing hospitals for overall patient safety” and is readily available online to the general public.

Nationwide Public Concern
As the public has become more educated and aware and has gained access to multiple resources online, the demand for legislation requiring hospitals to openly report and be accountable for their infection rates has been growing. An article in the February 2004 issue of Consumer Reports cites a report from the Institute of Medicine of the National Academy of Sciences, stating that nosocomial infections affect about 1 in 20 hospital patients and add almost $35 billion per year to our nation’s health costs.2 Consumers Union, the publisher of Consumer Reports, hosts a website called “StopHospitalInfections. Org,” in which they demand the sharing of information regarding the nosocomial infection rates of hospitals and charge: “End hospital secrecy and save lives.”3 According to the July 13, 2005 edition of the Wall Street Journal,4 5 states have passed legislature requiring hospitals to regularly report nosocomial infections and many more, including New York, have “similar measures pending.”

The Bigger Picture
Focusing on infection rates alone does not provide a clear picture of the scope of the problems of nosocomial infections. An article in Emerging Infectious Diseases stated that although the nosocomial infection rate has remained at approximately 5 to 6 hospital-acquired infections per 1000 patient days has actually increased 36%.5 Consequently, the actual number of patients with nosocomial infections per year has increased substantially even if the rates have remained stable.6 If we use these statistics, a hospital that handled 10,000 critical care patients per year 10 years ago may now see a total of 13,600 of such patients yearly. If the nosocomial infection rate held steady at 5%, the total number of critical care hospital-acquired infections would increase by 180 patients, from 500 to 680 per year. At a mean cost of $38 656 per infection, those additional 180 patients mean an increased cost of almost $7 million per year for this hospital, as well as significant increases in mortality rates and length of stay.7

Steps to Overcome the Problem
With this rising threat to patients’ welfare as well as the economic risk, hospitals have, over the years, developed infection control departments and procedures. Although transmission of bacteria from one source to another was proposed in the 1840s by Ignaz Semmelweis, who demonstrated the importance of hand hygiene for controlling transmission of infection in hospitals,8 infection control departments and procedures were not initiated until the 1950s in response to the growing number of staphylococcal infections in hospitals. Measures to reduce infections have included better hand-washing techniques, stronger cleansers, a reduction in potential carriers of infection such as acrylic nails, and replacing reusable medical equipment with single-patient disposable equivalents. Nosocomial pathogens from environmental surfaces and medical equipment are a threat to hospital patients, and these pathogens vary in their susceptibility to antibacterial cleaners and in the length of time they remain viable. Bacteria such as methicillin-resistant Staphylococcus aureus and vancomycin-resistant enterococci may threaten cross-contamination because they are found on objects in the patient’s room and may be carried directly or indirectly from patient to patient.9 Evidence shows that some of these bacteria can survive for at least 5 weeks on surfaces of medical equipment after the initial outbreak of infection has been eradicated.10

Growing Resistance
On October 20, 2005, Infectious Control Today, an online source that describes itself as “the voice of authority in infection control” provided an article claiming: “Antimicrobial resistance among bacterial pathogens has become a serious health threat, as the incidence of infections with such organisms has risen at an alarming rate. [Methicillin-resistant Staphylococcus aureus] MRSA, Vancomycin Resistant Enterococci [VRE],
Drug-Resistant Striphlococcus pneumoniae (DRSP) and gram negative bacilli possessing the ability to produce Extended Spectrum Beta-Lactamases (ESBL) have become frequent pathogens causing infections in both hospital and community settings. The article goes on to state that the "increase in resistance leads to greater morbidity, mortality, and cost, and has challenged the medical field and pharmaceutical industry in the development of prevention and treatment strategies."3

As a result of the well-documented abuse of antibiotics, and the plethora of widespread use of antibacterial agents, the fight to eliminate nosocomial infections has been severely compromised by the increase in antibiotic-resistant strains of bacteria. The development of multiple resistant strains of bacteria should not come as a surprise in that resistance is the natural and expected result of multiple exposures of microbes to chemical countermeasures such as antibiotics and antibacterial agents. As new antibiotics and antibacterial agents are introduced, microbes' development of resistance to these newer agents is the natural response.7 The Food and Drug Administration (FDA) recently reported major concerns about the use of antibacterial soaps and their relationships to the development of resistant strains of bacteria. Therefore, efforts to eradicate resistant infections by means of cleaning with antibacterial agents and the use of prophylactic antibiotics are actually counterproductive and increase the likelihood of furthering the resistance in microbes.

Efforts to address resistant bacterial infections by relying on new FDA-approved drugs would be a losing battle, according to the Centers for Disease Control and Prevention (CDC) as well as the Institute of Medicine. Whereas 16 new antibacterial agents were approved between 1983 and 1987, according to the CDC, the number has declined dramatically in the past few years.18 Conversely, the ratio of resistant strains of bacteria to their nonresistant counterparts has increased sharply in the past few years.19 The Institute of Medicine states, "Even if the pharmaceutical industry were to step up efforts to develop new replacement drugs immediately, current trends suggest some diseases will have no effective therapies within the next ten years."20

Consequently, because pharmaceutical agents will not sufficiently address the problem of resistant bacteria, prevention will be the paramount defense against a proliferation of hospital-acquired infections.

**Vital Means of Prevention**

Using disposable equipment has become a credible method of reducing the risk of transmission of nosocomial infections through cross-contamination. Not only is the use of such disposables more sanitary and convenient, but the high cost of each nosocomial infection allows us to make a case for disposable items being more cost-effective.2-5 Historically, from transient to multipatient pulse oximetry probes, the understanding that bacteria are transmitted from patient to patient via reusable equipment vectors has led to this drive toward disposable, single-patient-use medical equipment.3,5

It is incredibly, one potential source of infection has yet to be significantly examined. Where once everything from bedpans and enema bags to patient drains and tracheostomy tubes was reusable, now the only piece of medical equipment that come in contact with the patient's torso that are not single-patient use and disposable are the electrophrocardiography (EOG) wires. How these nondisposable wires used on multiple patients have escaped close scrutiny until now is difficult to understand.

**Risk of Infection From ECG Wires**

According to Infection Control Today,21 the American Society of Microbiology did a study in which they found that 47.6% of 42 neckties worn by male clinicians "harbored potential pathogens." The study concluded, "the link between a necktie and the potential for transmission of pathogens must be considered."20 A physical barrier is usually present between a patient's skin and a clinician's tie. If clinicians' ties are not decontaminated properly, this could mean contamination risks, how much more of a risk are ECG monitoring wires, which are in direct contact with patients' skin? These wires have multiple surfaces that are difficult to reach with cleaning agents. The wires also frequently come in contact with patients' blood and body fluids, which seep into the smallest recesses of connections, thereby providing a perfect, virtually unsanitary medium for the growth of bacteria. ECG wires attached to the oxygen modules or the monitor to the patient's bedside. These wires were cultured after they were reprocessed and just before they were attached to new patients in the intensive care unit (ICU). The researcher, Dr. Paul R. Brookmeyer of the University of Wisconsin Hospital and Clinics, Madison was quoted as saying the wires are "an unappreciated reservoir of multidrug-resistant nosocomial pathogens." In addition, the article concluded that "attachment of contaminated lead wires to a new patient can result in colonization and ultimately in invasive infection by multiresistant nosocomial microorganisms."19,21-22

ECG wires, thus identified as carriers of resistant strains of bacteria and an invasive infection risk, were thus linked directly to the root cause of cross-contamination infection in an article from the Division of Infectious Diseases at the University of Texas, Medical Branch in Galveston. The burn unit of that university hospital experienced "an outbreak of colonization and infection caused by vancomycin-resistant enterococci." Five weeks after the apparent eradication, the outbreak reoccurred. The reemergence of the infection was traced to one ECG lead wire.3,18 In addition to this account, Wisconsin hospital epidemiologists attributed an outbreak of Serratia marcescens infection to insufficiently decontaminated ECG leads.22 Unfortunately, these reports show that merely following a cleaning protocol for ECG wires was insufficient to eliminate the risk of cross-contamination. What unit would be more diligent in decontamination than a burn unit attempting to eradicate an outbreak of vancomycin-resistant enterococci?

**Guidelines on Infection Control**

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) considers infection control of sufficient importance to include it as 1 of 3 goals in each of its 2005 patient safety goal categories. The overwhelming JCAHO focus is on prevention. They state: "Prevention of health care-associated infections (HAIs) represents one of the major safety initiatives an organization can undertake." They further state that "Joint Commission standards focus on reducing the risks of such infections and, in the case of hospitals, call for at least one activity in the infection control process to be aimed at preventing the transmission of infections."24

Elimination of an identified source of transmission of resistant bacteria, such as reusable ECG wires, would be an ideal response to JCAHO guidelines but more importantly, use of disposable leads
wires would eliminate this threat to both institutions that use them. Disposable ECG sources of hospital-acquired infection in any wires must be considered a potential carrier of resistant bacteria and a cause of nosocomial infection. Therefore, these measures. In this clinical path of prevention, remain at the forefront of prevention spreading nosocomial infections must using disposable equipment to avoid development of resistance. Consequently, when used frequently and as prophylactic not sufficient to eliminate this risk, and, Antibiotics and antimicrobial agents are Summary credit that statistic, at least in part, to the use infections attributable to ICU and telemetry patients, we have not had 1 nosocomial infections. The frequency of sternal wound to reduce the incidence of sternal wound infections decreased more than 90% in all 3 hospitals. Hospital administrators attribute those results, in significant part, to the use of disposable ECG leads.

Bon Secours St. Frances Hospital, in Midlothian, Va., opened its doors for the first time in September 2005. Ricky DeJesus, administrative director of critical care, states, “The concept of Bon Secours St. Frances is that we are the medical facility of the future. In keeping with this, we started using disposable leads from the beginning in our critical care and telemetry areas. There is enough evidence out there to convince me that there is a significant risk of infection in reusable wires. Although we have had many central [catheters] and surgical patients, we have not had 1 nosocomial infection attributable to ICU and telemetry since we opened our doors 4 months ago. I credit that statistic, at least in part, to the use of disposable ECG leads.”

Author Disclosure
Donna Quinton Brown is a regional sales manager for GMP Wireless Medicine, Ft. Lauderdale, Fla.

References