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GUEST EDITORIAL

Copper-silver ionization: Cautious optimism for *Legionella* disinfection and implications for environmental culturing

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Legionnaires' disease is now a well-established nosocomial problem. Although a few early reports suggested that cooling towers were reservoirs for the organism that causes the disease, virtually all reports since 1982 have shown that water distribution systems are the major reservoirs for the organisms that cause legionnaires' disease when it is acquired in the hospital.

Each of the two most common disinfection measures used for legionella, "superheat and flush" and hyperchlorination, has some disadvantages.[1] The "superheat and flush" method, although effective on a short-term basis, must be reinitiated periodically because colonization gradually recurs during a period of many months.[1,2] Furthermore, this method is logistically demanding because distal water sites must be flushed for an extended period of time and hot water temperatures must be monitored during the flushing. The inability of some hot water tanks to maintain the flushed water at 140° to 170° F can be a limiting factor.

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In some hospitals hyperchlorination is the chosen method of disinfection because, in contrast to the "superheat and flush" method, it does not inconvenience health care personnel or patients. However, the hyperchlorination method has proved to be problematic; after it is used for 5 to 7 years, corrosion of pipes can lead to leaks with subsequent water damage within the hospital. In some hospitals, measures to minimize corrosion have cost more than the chlorination system itself.[3] In addition, the hyperchlorination method has only marginal efficacy. In most hospitals in which hyperchlorination is used as the sole mode of disinfection, an occasional case of legionnaires' disease continues to appear. If the chlorinator malfunctions because of equipment problems or operator error, recolonization can recur quickly and cases of the disease acquired in the hospital will rapidly appear.

As reported in the detailed study by Miuetzner et. al.[2] published in this issue, copper-silver ionization, an innovative, high-technology approach, has proved to be a highly efficacious disinfection method. Within 1 month, colonization of legionella had dropped from 72% to 2%. In addition, unlike the experience with the "superheat and flush" method, effective suppression of legionella was maintained for the entire follow-up period of almost 2 years.

Copper-silver ionization has major advantages when compared with hyperchlorination. First, the

efficacy of copper-silver ionization appears to be superior to that of hyperchlorination. Second, when the copper-silver ionization units are inactivated, residual protection may be sustained for several months[4,5]; hyperchlorination, on the other hand, does not provide residual protection after it is deactivated. The suppression of legionella is prolonged with the copper-silver ionization method because copper-silver ions penetrate the biofilms within the piping and kill the legionella,[6] whereas chlorine merely suppresses the organisms. Third, safety may be an issue with the hyperchlorination method because of the relatively high concentrations of chlorine required for suppression. With copper-silver ionization the levels of copper and silver ions required for effective disinfection are well below the levels designated as safe in the standards established by the Environmental Protection Agency. In contrast, meta-analyses have suggested that chlorination at concentrations currently used for drinking water are carcinogenic[7]; the concentrations of chlorine used to suppress legionella are fourfold to ninefold higher, with a presumed attendant increase in the risk of carcinogenicity. Thus many hospitals have abandoned hyperchlorination in favor of copper-silver ionization. Surprisingly, the cost of a copper-silver unit is usually less than that of a chlorinator.

We nonetheless advise that the apparent technical advance of copper-silver ionization be viewed with caution and restrained optimism. Although a number of hospitals that have had copper-silver units for at least 5 years remain satisfied with the performance of the units, in many hospitals long-term efficacy of the units has yet to be evaluated. In addition, the emergence of legionella resistant to the action of copper and silver is a theoretical concern.

Vigilance is still required in hospitals in which copper-silver ionization systems are installed. Routine environmental cultures for legionella should be continued, albeit less often, to document the continued efficacy of copper-silver ionization (or, for that matter, any disinfection modality). Hospital personnel must realize that distal water sites that are not frequently used may occasionally yield low numbers of legionella because the disinfectant may fail to attain sufficient concentration for eradication. However, the existence of a small number of sites that have positive test results may not pose a hazard to patients.[8]

Long-term success in legionella disinfection requires the commitment of a multidisciplinary team consisting of administrators, engineering personnel, and infection control practitioners. In our opinion infection control practitioners are critical to the success of any disinfection program. Both the concentration of copper-silver ions and environmental cultures should be monitored periodically (we suggest 4 to 6 times per year). Physicians should have a high index of suspicion for the legionella organism if environmental cultures are positive. Patients with nosocomial pneumonias of unclear cause should undergo specialized tests for legionella. An infection control practitioner is the ideal person to coordinate disinfection efforts and ensure that the necessary tasks are performed.

The advent of copper-silver ionization may reap another benefit. Controversy concerning the advisability of obtaining routine environmental cultures for legionella continues to smolder.[9] Surveys assessing legionella colonization of water distribution systems have shown that the range of colonization in various hospitals in the United Kingdom, United States, and Canada range from 12% to 70%.[10-13] Epidemiologic studies have documented that colonization poses a risk to hospitalized patients; conversely, cases of legionnaires' disease are not found in the wards of hospitals that do not have legionella in their water supply.[14-16]

It appears logical that one cost-effective approach of determining the risk of acquiring legionnaires' disease in hospitals would merely be to survey the water distribution systems of hospitals by obtaining cultures from their hot water tanks and distal water sites. Allegheny County, Pennsylvania, has formally adopted this approach for all hospitals within the county.[17] Nevertheless, many authorities, most notably those at the U.S. Centers for Disease Control, are adamantly opposed to the practice of obtaining routine environmental cultures to check for legionella. One of the major reasons for their intransigence is their fear that many hospitals may institute expensive disinfection measures despite an unknown risk for legionnaires' disease.[18] The availability of a less expensive but more effective method of disinfection should remove an obstacle for the routine use of environmental cultures to check for legionella. We predict that once the practice of obtaining environmental cultures becomes an established procedure in most hospitals and legionella diagnostic tests are instituted, significant numbers of cases of legionnaires' disease that were acquired in the hospital will be uncovered. Preventive methods using cost-effective disinfection measures including copper-silver ionization can then be applied.

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