PREVENTION AND CONTROL OF HEALTHCARE-ASSOCIATED WATERBORNE INFECTIONS IN HEALTHCARE FACILITIES

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ABSTRACT

This is a review of the public health risks attributable to waterborne pathogens in healthcare. The consequences of healthcare-associated infections (HAIs) are discussed. Not only are Legionella spp. involved in HAIs, but also Pseudomonas aeruginosa, other Gram-negative microorganisms, fungi and amoebae-associated bacteria. This is particularly noteworthy among immunocompromised patients. New prevention strategies and control measures brought about through advanced planning, facility remodelling and reconstruction, disinfection, and filtration have resulted in a significant reduction of the incidence of waterborne HAIs. The positive consequences of a comprehensive multi-barrier approach including prevention and control programs in healthcare facilities are discussed. Environmental cultures are now integrated within the infection control program of some European countries. In high-risk areas, the application of disposable point-of-use sterile filters for faucets and shower heads appears to be the practice of choice to efficiently control waterborne pathogens and to prevent infections.

Key words: waterborne pathogens - healthcare-associated infections - Legionella - Pseudomonas aeruginosa - other Gram-negative bacteria - waterborne infection - nontuberculous mycobacteria - aspergillus - amoeba-associated bacteria - amoeba-resistant microorganisms - disinfection - biofilms

MICROBIAL RISK MANAGEMENT IN HOSPITAL WATER SYSTEMS

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Finished drinking waters frequently carry a total number of bacterial cells of about 108 cells/L with less of 0.01% of culturable heterotrophic bacteria (HPC), most of them being unidentified. Depending on the water source and its treatment, one may estimate there is at least 1% (106/L) of viable but non culturable bacteria (VNC).

The bacterial biomass carried out by the finished water is multiplying into the network, resulting in higher bacterial concentrations exceeding sometimes the maximum permitted in drinking water. The proliferation of these bacteria occurs in the bulk water (from 0 to 30%) but also in the biofilms (from 70 to 100% of the bacterial production). The biofilm accumulation and activity are controlled by a large number of factors (hydraulic regime, nature or concentration of nutrients, density of bacteria and species introduced into the network, nature of the distribution materials, predators) which effects are not always predictable.

There is increasingly concern about accidental intrusions of pathogens into distribution systems or deliberate pathogen contamination. Deficiencies in distribution systems (in addition to breakthrough) include cross-connection and back-siphonage, contamination while in storage, contamination during construction/repair, and broken and leaking mains. Pathogens introduced in drinking water distribution systems implant biofilm or deposits, which may then be regarded as transitory reservoirs of pathogens.

Then hospital drinking water distribution systems may serve as a potential indoor reservoir of pathogens or potentially pathogenic microorganisms: *Pseudomonas aeruginosa, nontuberculous Mycobacteria, molds (Fusarium, Aspergillus…), Legionella*, etc. These microbiologically contaminated drinking waters have been suspected to be cause of community-acquired infection for several years, and repeatidly waterborne nosocomial infections are reported. By way of consequence, an estimated 1,400 deaths occur each year in the USA as a result of waterborne nosocomial pneumoniae caused by *Pseudomonas aeruginosa* alone.

Despite the availability of effective control measures and guidelines, no clear single strategies exist for the prevention of these infections. Because of the seriousness of these nosocomial waterborne infections, this paper tries to analyse some of the major causes of drinking water contamination, and gives a critical review of multistep barriers used for preventing exposure of patients.

ECOLOGY OF PSEUDOMONAS AERUGINOSA IN THE INTENSIVE CARE UNIT AND THE EVOLVING ROLE OF WATER OUTLETS AS A RESERVOIR OF THE ORGANISM

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In spite of the significant changes in the spectrum of organisms causing intensive care unit (ICU)-associated infections, Pseudomonas aeruginosa has held a nearly unchanged position in the rank order of pathogens causing ICU-related infections during the last 4 decades. Horizontal transmissions between patients have long been considered the most frequent source of *P aeruginosa* colonizations/infections.

The application of molecular typing methods made it possible, during the last ; 7 years, to identify ICU tap water as a significant source of exogenous *P aeruginosa* isolates. A review of prospective studies published between 1998 and 2005 showed that between 9.7% and 68.1% of randomly taken tap water samples on different types of ICUs were positive for *P aeruginosa*, and between 14.2% and 50% of infection/colonization episodes in patients were due to genotypes found in ICU water.

Faucets are easily accessable for preventive measures, and the installation of single-use filters on ICU water outlets appears to be an effective concept to reduce water-to-patient transmissions of this important nosocomial pathogen. *(Am J Infect Control 2005;33:nnn-nnn.)*