New trends in infections associated with swimming-pools

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Abstract

It has long been known that swimming-pools and related recreational facilities can sometimes transmit any of a wide variety of infectious diseases. The frequency of different pathogen involvement is subject to many factors. Current trends which play an important role in the selection of infection risks, include the growing popularity of indoor pools, heated pools, whirlpools (Jacuzzis), water slides and waterfalls. These new facilities, in combination with other changing factors, favour pathogens and risks of infection which previously had been less important. Health risks are, therefore, moving targets which present ongoing and special challenges to research and quality control in the pool industry.

Introduction

The transmission of a wide variety of infectious diseases by swimming-pool water has been confirmed by sound evidence based on epidemiological findings and data on the quality of the water concerned. Immersion of the entire body into water offers many routes of entry to pathogenic micro-organisms. These routes include the gastro-intestinal tract due to the swallowing of water. In addition, pathogens have direct access to susceptible tissues such as mucous membranes of the respiratory and urogenital tracts, the conjunctiva of the eyes, epithelial cells in skin abrasions and wounds, and soft tissues of the ear and middle ear.

Pathogens may directly enter the blood stream through wounds and even minor skin lesions. The consistent inhalation of aerosols, and occasionally even water, offers direct access to the lungs.

The epidemiology of infectious diseases associated with swimming-pools and related water recreation is complicated by various factors which tend to either overestimate or underestimate the role of the water per se. For instance, water recreation offers ideal opportunities for the transfer of pathogens through other routes than water. Most important is close personal contact which facilitates the transfer of pathogens through droplets and direct inoculation into susceptible tissue, as well as transfer through the sharing of towels, etc.

It must also be kept in mind that man is not a water animal, but a land animal. His armament of resistance to pathogens does, therefore, only make limited provision for attack through external exposure to water. For instance, prolonged and vigorous activity in water reduces natural resistance by removal of protective layers such as mucus, wax and scab, which protect vulnerable tissue, skin lesions and wounds. This results in increased susceptibility to infection, often including susceptibility to a person's own natural flora, as well as various opportunistic pathogens.

The role of swimming-pools in the transmission of disease often tends to be underestimated in terms of secondary and even tertiary spread of infections. This refers to the situation where an individual contracts an infection in a pool and then transmits the pathogens to other people by means such as personal contact which have nothing directly to do with the pool. Indirectly, however, the pool remains the source of infection.

The secondary spread of infections is difficult to trace epidemiologically. This becomes virtually impossible when the individual who becomes infected in the pool develops a subclinical infection. In children the great majority of infections by viruses such as polio, coxsackie and hepatitis A are subclinical. This event may also take place in adults. Although all these people show no symptoms of disease, they do excrete the pathogens and can infect others who in their turn again may or may not develop clinical disease. Despite difficulties, secondary and even tertiary transmission of infections contracted in swimming-pools has been confirmed epidemiologically (Kappus et al., 1982).

Although the transfer of many pathogens by swimming-pool water has been proven, and many other pathogens are potentially transferable but not yet confirmed, there are certain pathogens for which transfer through swimming-pool water is most unlikely if not impossible. This would, for instance include those pathogens which are transmitted by the direct inoculation of blood or blood products, such as the viruses which cause rables, haemorrhagic fevers, hepatitis type B, and the acquired immuno deficiency syndrome (AIDS).

Despite indications that the AIDS virus can survive for some time in water (Slade et al., 1989), sound evidence on the minimal infectious dose, survival in environments other than the human body, blood or blood products, and susceptibility to disinfectants such as chlorine, render the possibility for transfer of the virus via water negligible (Zuckerman, 1986; AIDS Review, 1987). This does, of course, exclude circumstances in which personal contact in the pool is extended to the level of sexual intercourse or other means of parenteral blood transfer. In this case the pool could hardly be blamed, at least not directly, for the infection.

An important feature of diseases transmitted by pools is that the risk for various infections is not consistent but follows certain trends. This is because the many factors which play a role in the selection of pathogens, and the mode of exposure to these pathogens, change continually, sometimes quite rapidly and drastically. Factors which currently direct these trends include the increasing popularity of indoor pools, heated pools and whirlpools (Jacuzzis), all of which result in extended exposure, exposure during cooler times of the year, prolonged personal contact, and selection for different pathogens.

A particularly important factor of new facilities such as whirlpools, water slides and waterfalls, is the extensive generation of aerosols. The prolonged inhalation of such aerosols creates ideal opportunities for respiratory tract infections. The classical example is Legionella pneumophila, which causes legionellosis, a pneumonia-like disease also known as "Legionnaire's disease". In addition, the proliferation of L. pneumophila is enhanced by elevated temperatures in new popular facilities such as whirlpools (Highsmith and Favero, 1985).

Other changing factors which affect the incidence and selection of diseases transferable by water recreation, include well-known...