Basic Concepts about Contagious Diseases

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Abstract

Contagious disease becomes an important part in human health now and in the future after visualization of microorganisms and identification of their pathophysiology centuries ago. The work of Louis Pasteur, Robert Koch, and others laid the foundations for the germ theory of disease, which in turn made advances in the control and prevention of many infectious diseases. Human may be vulnerable to new diseases or re-emerging pathogens. Human has also been developing new generations of antibiotics, but also evoked emerging organism. This article will discuss the causes of organism emergence such as effects of human behavior, the environment, or the microorganisms themselves. It is also emphasized that detection and response to contagious disease are very important for human health.*(Ann Disaster Med. 2005;3 Suppl 2:S79-S83)*

Key words: Contagious Diseases; Environmental Medicine; Wilderness Medicine

Introduction

There have been a lot of changes in our life in last three decades. The first is improved agriculture that led to better nutrition. The second is improved hygiene and sanitation which reduced the transmission of many infectious diseases. The most important one is that new generation of antibiotics and passive immunities make people resistant to known diseases.[1]

Declining infection rates and the changing age distribution of the population ever result in decreased importance of infectious diseases compared with other causes of death and disability. However, reemerging or drug-resistant infections have increased in the past two decades, and the incidences of these diseases threaten to increase in the near future. The infectious diseases include not only what had been recognized, but also the well-recognized pathogens which re-emerged as a threat to public health.

Drug-resistance was once perceived as primarily a problem in hospital-acquired infections. But now community-acquired infection has become increasingly drug resistant. It may be the results of interaction among the changes in society, technology and the microorganisms themselves. The pathophysiology of such newly developed infectious diseases and re-emerging contagious diseases deserves comprehensive understanding.

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Factors Influencing Emerging Disease

Human demography and behavior

Accompanied with social change, the increasing frequency of both parents working outside the home has led to greater use of day care. It is affecting the emergence of infectious diseases. The combination of susceptible children in day-care facilities, inadequate hygiene, frequent infections, and unnecessary antibiotics for upper airway infection by local clinic are the main causes of drug resistance in such community-acquired infections. Urbanization is the trend of the world, but also intrinsically increases interpersonal contacts. The spread of infectious disease is directly proportional to the density of population, and a crowed metropolitan region is susceptible to spread disease than a rural area does. Poor hygiene, poverty and low socioeconomic status are all important contributing factors for contagious diseases.[1,2]

Patients with certain immunocompromised conditions such as diabetes mellitus, chronic renal disease, chronic pulmonary disease and malignancy are at high risk of various infectious diseases. When chemotherapy for malignancy or immunosuppressive medication for organ transplantation are proved to make patient live longer, it also contribute to the emergence of infectious diseases. Aging, associated with physiological decay and development of systemic diseases, is another important factor associated with an increased susceptibility to infectious diseases.[1,2]

A variety of human behaviors are also influencing the emergence of infectious diseases. The unsafe sex increases the frequency of gonorrhoea, syphilis, and HIV. The use of alcohol or illegal medicine increases the possibility of disease transmission. In addition, frequent contact with pets would be the more likelihood for zoonotic pathogen transmission.[1,2]

Industry and technology

As new technology developed, people enjoy the convenience and comfort, but the artificial environment may be also suitable for development of some specific disease. The linkage between air-conditioning cooling towers and Legionnaire's disease, super-absorbent tampons and toxic shock syndrome, the fast-food hamburger and E. coli O157:H7 examples. As new agricultural industry improved, antimicrobial agents used for promoting growth, preventing and treating disease in animals, these antimicrobial agent may in turn result in emerging pathogens and influence human later.

Environment

As we start to encroach the tropical forest, we are at risk of exposure to unknown pathogens such as Ebola hemorrhagic fever. In large cities without adequate hygiene, the risk of disease transmission is high. Emerging pathogens from free-living wild animals may be related to three types of mechanism:[3]

(1) The proximity between wild animals and domestic animals

The transmission of infectious agents from reservoir animal populations (often domesticated species) to sympatric wildlife can lead to local (population) extinction, then the ultimate pathogen may threaten human.

(2) Direct human contact via parasite translocation.

This form of emergence is a particular concern

to the pathogen which is harmless for animal but may be harmful to human. And it may be transferred by vectors such as parasites or by direct contact. Wildlife plays a key role in their emergence by providing a "zoonotic pool" from which previously unknown pathogens may emerge. For example, nucleic acid sequence analyses have demonstrated direct transmission of avian influenza to humans.

(3) No human nor domestic animal involved. This represent that, many wildlife species are reservoirs of pathogens that threaten domestic animal and even human health. On the other hand, wildlife pathogens also pose a substantial threat to the conservation of global biodiversity.

Global climate change is likely to cause major changes to the geographic range and incidence of arthropod-borne infectious diseases. Expansion of mosquito vector geographical ranges has been proposed to explain the re-emergence of malaria and dengue fever in South America, central Africa, and Asia during the 1980s and 1990s.

Travel

The convenient transportation makes a global village. At the same time, infected person or food may be transferred rapidly and easily. Severe acute respiratory syndrome (SARS) is a good example. The early cases of SARS appeared to have originated in southern China.[4] SARS was carried out of Guandong Province on 21 February 2003, when an infected 64 year old nephrologist visited Hong Kong. He spent a single night on the 9th floor of a hotel and was admitted to a hospital on 22 February. At least 16 hotel guests and visitors had been infected by the nephrologist. It is believed to have been the source of infection causing subsequent outbreaks of SARS in Hong Kong,[5,6] Vietnam,[7] Singapore,[8] Taiwan,[9] and Canada.[10]

Microbial adaptation

As antibiotics developed, microorganism had started to fight the new generation of antibiotics. Beta-lactamase producing pathogens were notorious for a while until new generation of antibiotics which can't be hydrolyzed by such enzyme. However, extended spectrum beta-lactamase (ESBL) producing microorganisms were isolated later. It reflects the point mutation in the coding of beta-lactamase gene.[11,12] Altered cell membrance permeability and target sites for antibiotics were also mechanisms for emergence.[11,12]

Gene exchange is directed by transformation (uptake naked DNA), transduction (Transfer DNA from bacteriophage), or conjugation(cell to cell contact) .Example of microbial evolution is the emergence of E. coli O157:H7. It plays an important role of food-borne disease, causing bloody diarrhoea and a potentially fatal illness called the haemolytic uraemic syndrome. Another example is enterococci which gradually accumulate resistance genes by genetic exchange and develop into multiresistant nosocomial pathogens causing untreatable infections. It is notorious in nosocomial infection.

Breakdown of public health measures

Many preventive and control system for pubic health may be broken down during an epidemic because the system is usually designed for previous events and be due to the satisfied what had done for known pathogen. However, the-

ses microorganisms emerge, the re-activation seems to be multi-resistant, and not curable by previous medication. It may also result from limited resource and competing priority for pubic health program. Multi-resistant tuberculosis is a good example, and now we must fight to the new-generation of tuberculosis.

Disaster and Contagious Disease

Many rumors may be spread by newspaper or radio just after disaster, for example, typhoid or rabies. It reflex the fear of people rather than the true imminent problem. Disaster may disrupt the original hygiene, piped water, and increase vectors for pathogen spread. However, natural disasters rarely results in outbreaks of infectious diseases. The most route is fecal contaminated water and respiratory droplets.[13]

Unburied body has minimal rate for pathogen transmission, especially cause by trauma. The risk may be higher among those handle dead bodies than the survivors in disaster. But the risk can be lowered by proper vaccination, protect devices and delicate behavior. In general, the risk of emerging disease seems not to increase in the settings of natural disasters. It depends upon the vaccination, sanitation and hygene.[13]

Conclusion

We have entered an era when microorganisms become more and more resistant to modern antimicrobial agents. Antibiotics abuse, urbanlization, people's behavior, and microorganism adaptation are all the critical contributing factors. It is essential to use antimicrobials wisely and judiciously. Good response planning and training may be the only way to manage a biological event, either natural or man-made.

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