Introduction of Emerging Infectious Diseases

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1.1 Definition of Emerging Infectious Diseases (EIDs)

Emerging infectious diseases (EIDs) refer to contagious diseases newly appeared, or with drug resistance, whose incidences have been rapidly increasing and are likely to further rise in the future. EIDs are usually discovered in three ways. Firstly, some existing diseases are ascertained as EIDs due to the recent discovery of pathogens. Secondly, previously considered noninfectious diseases are identified contagious as a result of new etiological findings. Thirdly, new infectious diseases are incurred by various complicated reasons such as evolution of pathogens. Due to their uncertainty and unpredictability, EIDs could result in high mortality and great impacts on social stability and economic development as people are unable to react immediately and take specific preventive or control measures. Therefore, EIDs have become a major public health problem worldwide. Cases in point are the epidemics of SARS in 2003 and H7N9 avian influenza around 2006, which have eloquently demonstrated their great threats to human health, society, and economy. In the coming twenty-first century, contagious diseases are expected to remain as a crucial public health concern for countries around the world.

1.2 Classification of EIDs

At present, more than 40 kinds of EIDs have been found worldwide, and over 30 kinds have been reported successively in China. EIDs can be classified into the following five categories.

1.2.1 EIDs Caused by New Pathogens

Such contagious diseases did not exist in the past and newly emerge due to new pathogens such as AIDS, severe acute respiratory syndrome (SARS), human infection with highly pathogenic avian influenza H5N1, influenza A (H1N1), and human infection with avian influenza H7N9.

1.2.2 EIDs Caused by New Variant Strains

Such diseases are caused by new variants mutated from existing pathogenic microorganisms. For example, current study suggests that *Vibrio cholera* O139 may be the result of genetic mutation of O1 serogroup.

1.2.3 Newly Acknowledged EIDs

Some existing diseases are not recognized as EIDs until recently, such as hepatitis D and E, legionnaire’s disease, and Lyme disease.

1.2.4 Existing Noncontagious Diseases Redefined as EIDs

Some existing diseases considered noninfectious are found contagious in recent years, such as peptic ulcer caused by *H. pylori* and T-cell leukemia.
1.2.5 EIDs Endemic in Some Places

Contagious diseases endemic in some places become prevalent in new places and then are generally considered as EIDs, such as West Nile virus (WNV) that was once popular in Middle East and Europe and broke out in the USA in 2012.

1.3 Epidemiology of EIDs

1.3.1 Prevalence Characteristics

Pandemic and subject to multiple influential factors. For example, diseases like Lyme disease, Legionnaires’ disease, and peptic ulcer disease are globally distributed, SARS appears in 32 countries and regions, and BSE rages over 22 European countries.

Highly contagious and complex in dissemination routes. EIDs like Ebola hemorrhagic fever, SARS, West Nile encephalitis, and mad cow disease are all highly contagious through various channels.

Fast transmission with severe damages. AIDS, described as super cancer and the top killer in twentieth century, has been spreading across the world in an astonishing speed since diagnosed in 1981. In 2003, both the outbreak of SARS in spring and the highly pathogenic avian influenza H5N1 after mid-December caused casualties and huge economic losses. SARS, human avian influenza, and influenza H1N1 have all become rampant worldwide in a short time. Besides, convenient transportation and close international contacts also facilitate their spread.

Zoonotic. More than three quarters of EIDs are zoonotic and closely related to animals. Researches by Jones et al. revealed that 60.3 % EIDs were zoonotic, with 71.8 % caused by wild animals, such as human avian influenza and Ebola virus.

Difficult to prevent, diagnose, and treat due to the varied pathogens. Pathogens of EIDs mainly encompass viruses, bacteria, rickettsia, and chlamydia, predominantly viruses which are highly elusive and infectious.

Free of natural immunity in human populations. With strong variability, the viruses of EIDs are able to escape the immune barrier and develop resistance to drugs in new hosts as the environment changes. Therefore, people have no immunity to EIDs.

1.3.2 Influential Factors

Biological factors. Pathogenic microorganisms may mutate to adapt new environment. Therefore, nonpathogenic strains may become pathogenic, and attenuated strains become virulent, or evolve into new pathogens, thus giving rise to EIDs. Pathogens may generate numerous mutant strains by acquisition, recombination, or transfer of genes in a short time, part of which may develop into new pathogens of contagious diseases.

Natural factors. Global warming has changed the geographical distribution of vector insects and increased their reproduction speed and invasiveness. As a result, breeding time of pathogens outside human bodies is curtailed, making insect-borne contagious diseases more frequent.

Social factors. Deforestation, construction of dams, and other human activities can change the ecological environment. Additionally, population movement, sexual promiscuity, drug abuse, and other bad behaviors may cause and spread contagious diseases.

1.4 Clinical and Imaging Characteristics of EIDs

1.4.1 Clinical Signs of Infectious Diseases

Similar to other contagious diseases, EIDs progress through four periods: incubation period, prodromal period, period of apparent manifestation, and convalescent period.

1.4.1.1 Incubation Period

This period commences from the invasion of pathogens into human body and ends upon the appearance of clinical symptoms.

1.4.1.2 Prodromal Period

This period spans from onsets to manifestation of evident symptoms. Clinical manifestations are usually nonspecific and shared by all EIDs, such as headache, fever, fatigue, and muscle soreness. It commonly lasts 1–3 days.

1.4.1.3 Period of Apparent Manifestation

After prodromal period, some patients with acute contagious diseases enter the period of apparent manifestation. During this period, all the signs and symptoms of the infectious diseases usually fully manifest.

1.4.1.4 Convalescent Period

When human immunity grows to a certain extent, the pathological changes would come to an end, and patients’ symptoms and signs basically disappear, which is clinically called convalescent period. Some diseases can reoccur, and some may cause sequelae.
1.4.2 Clinical Imaging Characteristics of EIDs

Clinical imaging diagnosis is of great significance for the diagnosis, differential diagnosis, and efficacy evaluation of EIDs.

1.4.2.1 Necessary Imaging Examinations and Protection Should Be Carried Out for EIDs

In light of the strong infectiveness and variability of EIDs, imaging data are needed for their clinical diagnosis, differential diagnosis, treatment evaluation, and prognosis.

1.4.2.2 Basic Imaging Presentations of EIDs Are Ground-Glass Opacity and Pulmonary Consolidation Shadows

Mostly caused by viruses, EIDs have mainly such pulmonary imaging changes as rapid occurrence of ground-glass opacity and (or) pulmonary consolidation. Cavity and cystic changes can also be seen in some cases.

1.4.2.3 Dynamic Imaging Visualizes Rapid Changes of Lesions

For some patients, imaging presentations and clinical symptoms and signs are not consistent. For example, the imaging findings may be serious, while clinical symptoms are mild.

1.4.2.4 Lesion Absorption Is Slow

For example, the pulmonary interstitial fibrosis lesions of patients with human avian influenza H5N1 may procrastinate for several years.

1.4.2.5 Complications May Occur

During convalescent period, absorption of lesions is slow and imaging changes such as interlobular septal thickening and interstitial hyperplasia may be observed. For example, pulmonary fibrosis may be left in some SARS patients with severe pulmonary injuries after recovery as the absorption of pulmonary lesions take a long time. Moreover, patients with SARS or avian influenza H7N9 may be complicated with avascular necrosis of femoral head.

1.5 Measures and Strategies Against EIDs

1.5.1 A Disease Surveillance Network Should Be Erected and Ameliorated

Efforts shall be made to strengthen the surveillance of EIDs from organization system, personnel, equipment, and technological competence. By monitoring and investigation, we could timely detect new sources of infection or new pathogens and influential factors and take prompt and effective measures to rein in their spread and contagion. A global coordinated information platform for EIDs prevention and control shall be established and improved where countries shall timely communicate epidemic situation of EIDs and share experience for EIDs prevention and control so as to block large-scale spreading.

1.5.2 Improvement of Public Health Infrastructure and Training of Relevant Personnel

Public health infrastructure is fundamental to support public health preventive measures and to assess public health status. The high quality training of public health practitioners plays an vital role for the control of infectious diseases. Faced with the threats of emerging infectious, public health professionals should strengthen their training, and establish team culture to evaluate epidemiology of infectious diseases, thereby in the face of emerging infectious diseases outbreaks reasonable measures can be taken in an orderly manner to control the situation.

1.5.3 Scientific Research About EIDs Should Be Reinforced and Research and Development of Vaccines and New Drugs Accelerated

1. Conduct epidemiological studies to clarify the epidemic stages, characteristics, and influential factors of EIDs, so as to provide scientific evidences for formulation of prevention countermeasures
2. Accelerate the research and development of vaccines
3. Speed up the research of diagnostic reagents to form experimental methods for rapid diagnosis of EIDs
4. Carry out studies on pathogenic mechanism and early warning techniques for EIDs
5. Accelerate the research and development of new drugs, especially antiviral drugs
6. Build a strain resource bank of pathogenic microorganisms

1.5.4 Relevant Laws and Regulations Targeted at EIDs Should Be Promulgated

Prevention and treatment in line with laws should be geared up and relevant laws and regulations be enacted.
1.5.5 Attention Should Be Paid to Public Education and Information Communication

Multidisciplinary studies in public health and journalism and communication should be launched to address social panics caused by the outbreak of contagious diseases.

1.5.6 The Ecological Balance Between Nature and Human Beings Should Be Maintained

Preservation of ecological balance and natural environment is the fundamental way to control and reduce zoonotic contagious diseases, therefore precluding EIDs from the source.

Further Reading

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