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General introduction of Emerging & Re-Emerging Diseases

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Abstract
Emerging infectious disease are those diseases which recently appeared within the population and rapidly increasing as these are communicable diseases. It is threatens in future as well. These diseases increased from almost last 20 years and the increasing rate is 12% of all pathogens. But the irony is that 75% of population is still unaware about the causes, factors, reasons and consequences of these diseases. The research studies show the factor, causes, examples of emerging and re-emerging diseases which will help to the reader to develop the understanding with these new diseases.

Keywords: emerging disease, Re-Emerging disease, factors of emergence

1. Introduction

The term "disease" mentions to conditions that disturb normal body function and contain specific symptoms. An infectious disease is a disease that is caused by the invasion of pathogen into a host by different modes whose activities harm the host's tissues and can be transferred to other persons and they become infectious. Factors behind impairment of functions of organs or system can be intrinsic or extrinsic. Intrinsic factors originate from within the host and may be due to the genetic characteristics of an individual. Entry of pathogen into host is mostly by routes like as the mouth, eyes, genital openings, nose and the skin. Harm to tissues mainly results from the growth and metabolic processes of infectious pathogens within body organs/tissues, with the production and secretion of toxins, enzymes that cause damage to the normal functions of organs and/or systems. These harmful secretions/compounds may be distributed within body or specific organ/tissue and cause serious damage to their functions. Infectious disease originates when the immune system of an individual fails to eliminate pathogenic infectious agents from body.

The terms “emerging and re-emerging diseases” were given by Joshua Lederberg, Robert B. Shope, and Mary Wilson in 1987. These terms are used in reference of infectious diseases which found in humans has either increased within the past two decades or may be dangerous to increase in the near future. EID (Emerging Infectious Disease) can be divided into two major categories - newly emerging and re-emerging infectious diseases. Newly emerging infections refer to diseases that have been discovered in the human as a host or a population for the first time. Re-emerging infections can be defined as those infectious diseases that generally re-emerge in more virulent form and their occurrence increase fast at same or new geographic locations after evident control or eradication. Emerging diseases are those infections which occurrence have not ever seen in past and re-emerging disease are those which were seen earlier but have now reappeared in a more virulent form after a long duration of disappearance (e.g. influenza A, tuberculosis, malaria and dengue). Emergence of new pathogens due to microbial growth and conversion into newly modified infectious forms, change in human responses towards infections, variation in population, industrial, agricultural and economic progress. The re-emergence of diseases have taken lead due to insufficient public health measures for infections, development of antimicrobial resistance due to overuse of drugs in humans and development of adaptation in infectious agents.

2. Examples of emerging disease

The importance of zoonoses in the emergence of human infectious diseases cannot be neglected. Around 61% human microbial pathogens and 73% emerging human pathogens identified during the past two decades are zoonotic [4]. Some examples of zoonotic diseases are anthrax, brucellosis, leptospirosis, plague, rickettsial disease. Some other examples of emerging infectious disease are HIV/AIDS, SARS, MERS, Ebola, Marburg Hemorrhagic fever, Lassa fever, Nipah virus, etc.

AIDS emerged about a century ago during which the virus evolved itself from one primate host to another (chimpanzees to humans) and after that it spread readily within the human population due to many social and geographical factors [8]. Other examples of emerging disease is SARS (Severe Acute Respiratory Syndrome) which causative agent is SARS-CoV was emerged into 2002 from bats & civets and spread into humans by airborne transmission. Nipah virus was emerged in 1998-99 from fruits bats and its causative agent is Nipah virus (*Paramyxoviridae* Family). The reservoir hosts are infected pigs and infection is transmitted by direct contact with infected pigs and secretions and body fluids of infected bats. In 2009, H1N1 strain of Influenza virus A was emerged from pigs due to mixing of human, swine, and avian influenza genes [9]. H5N1 influenza was emerged from wild birds. It is also called Avian Influenza which was transmitted from infected birds, environment and infected poultry to humans. Crimean-Congo Haemorrhagic Fever was emerged in 1944-45 which causative agent is Nairovirus (*Bunyaviridae* family) and reservoir hosts are domestic animals & ticks and transmission of infection by bites of ticks, zoonotic contact, blood, secretions and infected body fluids. Ebola is also top most emerging disease which was emerged in 1976 and caused by Ebola virus (*Filoviridae* family). Reservoir host of Ebola virus are fruit bats and infection is transmitted by infected blood, body fluids, secretions of non-human primates and humans. Marburg Haemorrhagic Fever (MHF)

was emerged by Marburg virus (*Filoviridae* family) in 1967. MHF is mainly transmitted from human-to-human. MERS (Middle East Respiratory Syndrome) was emerged in 2012 and its causative agent is MERS-CoV (*Coronaviridae* family). Reservoir host of MERS is camel and it is transmitted by zoonoses only. No human to human transmission is noted. Lassa fever was emerged in 1969 and its causative agent is Lassa virus from *Arenaviridae* family. Host of Lassa fever are Mastomys rats and infection is transmitted by contact with infected animals, their body fluids and secretions [6].

2.1 Symptoms and Treatment

Clinical signs and symptoms of all these diseases are almost same. It contain fever, myalgia, headache, nausea, diarrhea, shortness of breath. Chronic symptoms are internal/external bleeding, nervous system problems, pneumonia, gastrointestinal problems, respiratory failure, kidney failure, even brain inflammation can cause coma.

Mechanism of pathogenesis is not well understood. Due to similarity of symptoms, it is difficult to recognize these diseases from other common diseases. These diseases can be diagnosed by serological tests such as virus isolation by cell culture, RT-PCR, ELISA, neutralization tests.

No vaccines are available for these diseases. Antiviral treatment of Ribavirin is available for some disease like Crimean-Congo haemorrhagic fever, Nipah and Lassa fever. Little relief can be obtained by general and meditative supportive care and precautions [6].

3. Examples of re-emerging disease

Re-emerging infectious disease pathogens first appeared long ago, but have existed and endured by adapting to changing human populations and to environments that have been changed by humans. Dengue virus and West Nile virus (WNV) are good examples. WNV has become adapted to multiple mosquito and avian species which are major factor in increasing its chances to infect humans. Cholera has continuously re-emerged over so many years in association with global travel, altering seasons, natural tragedies, insufficient sanitation conditions, poverty and social disruption. *Clostridium difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA) sre also adapted against immune system by over and inappropriate use of antibiotics [8].

Drug resistance mutations have also caused the re-emergence of certain pathogens such as multidrug-resistant and extensively drug-resistant tuberculosis, drug-resistant malaria.

***Chikungunya*:** *Chikungunya* virus (CHIKV) infection, which has re-emerged in recent years, is caused by a single-stranded RNA virus belonging to the family *Togaviridae*, genus *Alphavirus*. It was first isolated during a epidemic in Tanzania in 1952. Chikungunya is transmitted by mosquitoes of several *Aedes* species which bite during daylight hours. *Aedes aegypti* and *Aedes albopictus* are the main vectors that transmit dengue virus to humans. There is no direct person-to-person transmission. There is always maximum chances to get this infection in those areas where Chikungunya is endemic, especially for travelers and immunosuppressed persons. The first outbreak in India occurred in 1963 in Kolkata, and then in Chennai in 1964. Slowly this virus was distributed in many areas till 1973, when there was a small outbreak in Maharashtra. After more than three decades, India was almost free of this virus. However, widespread reports from Andhra Pradesh, announced its reemergence in 2005 [11]. Two reasons have come in light to this re-emergence. One is the presence of a sensitive, non-immune population in India for circulation of the virus. The other reason is a kind of mutation that evolved during the transmission of the current CHIKV strain. These reasons have been related with a high capacity of infectious agent to emerge epidemic and the possibility of transmission by *Aedes albopictus*, followed by *Aedes aegypti* that is the traditional vector in India [7].

4. Factors that leads emergence & re-emergence

There are environmental, social, industrial factors that are associated with emergence of disease. Generally, Emergence of new pathogens due to microbial progression and their adaptation, mutational changes, change in human life style, migration of population, industrial, agricultural and economic development.

Major societal factors of these infections are increase in population size, poverty and malnourishment, environmental pollution and global warming. Others are crowding, inappropriate infrastructure, poor hygiene, insufficient water supply and poverty that boost transmission of infectious diseases.

Emergence and re-emergence of infectious diseases take a long period of time to modify and become more resist to the existing drugs. To cause an epidemic, infectious agents take very long time to acquire more modified pathogenic characteristics in a new host. Gene mutation, genetic recombination, re assortment are some methods that help microbial agents to make changes in reservoir hosts to get opportunities for these agents to grow, adapt and replicate into new hosts in new ecological niches and spread easily.

Specifically, the factors affecting the environment contain deforestation, enlargement and modernization of agricultural techniques and natural tragedies such as floods. These effectively lead to changes in microbial ecological niches and development of resistance to human host.

Besides host and environmental factors, Exposure to chemicals, physical and antimicrobial agents (e.g. UV radiation, antibiotic, etc.) may lead mutation in the genome of a pathogen. It may lead emergence of drug resistant pathogens that could cause new disease. Thus, human, microbial, and environmental factors composed major causes of infectious disease emergence and the virulence [3, 6].

5. Prevention & Control

Prevention is always better than cure. To decrease and control emergence of diseases, precautions, vector control, reduction of infected insects burden, pesticide management, provision of safe drinking water, basic sanitation and hygiene practices, awareness and education, veterinary public health services are some of the public health strategies operated by the WHO and national level health agencies [2,14]. Surveillance at regular interval is necessary to analyze the current situations at various levels. The ultimate goal of infectious disease control is to achieve total eradication.

6. Conclusions

Emerging and neglected infectious diseases are a biggest health threat for population and infectious disease outbreaks may be left serious social, environmental, and economic

effects. A large number of factors relating to infectious disease emergence and transmission. National and international organizations collaborations, effective strategies and appropriate financial support of the public health infrastructure and poverty reduction are very essential for labelling emerging infectious disease warnings. There is a need to develop improved diagnostic facilities which should be rapid, specific, simple and cost effective.

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