

Ancient Diseases-Microbial Impact

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Abstract

There are several diseases in ancient days, to which people got affected, suffered and died too. These ancient diseases caused by microbes are divided into sub categories depending up on the source through which they have affected people. Those are Food and water borne diseases, air borne diseases, vector borne diseases, etc. Although we got succeeded in curing these ancient diseases, by the grace of medicines and antibiotics, microbes are still emerging day by day by showing many mutations and have becoming an ever green challenge to the present scientific community.

Keywords: Microbes; Diseases; Botulism; Cholera; Typhoid; Polio; Anthrax; Influenza; Measles; Smallpox; Tuberculosis; Dengue; Plague; Malaria; Rabies

Introduction

There are several diseases in ancient days, to which people got affected, suffered and died too. These diseases are termed as ancient diseases. Some of the ancient diseases include pneumonia, tuberculosis, chicken pox, small pox, rickettsia, influenza, rabies, etc. There are many reasons for these ancient diseases and some of the reasons include, maintaining unhygienic conditions, Illiteracy and lack of scientific knowledge.

An amazing and unbelievable fact is we lost many of our eminent scientists and young researchers by the grace of these microbes, as they got affected while working with those pathogens. A separate branch has evolved to read about these microbes called microbiology. Anton van Leeuwenhoek, a man who observed the presence of microbes first time by using his magnifying lens, is considering as father of microbiology and Louis Pasteur who have done many inventions in the field of microbiology is considering as Father of modern microbiology.

Microbiology is the study of living organisms, which are invisible to the naked eye. There are different types of microbes (bacteria, algae, fungi, protozoa, viruses, etc.) which plays major role in causing diseases. Microbes are ubiquitous in nature. They live in each and every part of biosphere including hot springs, soil, ocean floor, atmosphere and also in the Earth's crust. In ancient days, people got affected with diseases, when they got in touch with the regular environment like water, air, soil, etc.

These ancient diseases caused by microbes are divided into sub categories depending up on the source through which they have affected people. Those are Food and water borne diseases, air borne diseases, vector borne diseases, etc. Diseases spread through Food and water is commonly known as Food and water borne diseases and some of the Food and water borne ancient disease include Botulism, Cholera, Typhoid, Poliomyelitis, etc.

Food Borne Disease

Botulism is a Food borne disease, which is caused by *Clostridium botulinum*. Botulism was named after the Latin Botulus. *Clostridium botulinum* (CB) was first cultured by Van Ermengen in Belgium in the year 1898. This is a gram-positive anaerobic bacterium [1], which affected our ancestors more in ancient days. Botulism is a rare and life-threatening disease caused by intentional or accidental exposure to botulinum toxins. Botulinum is a neurotoxin that irreversibly blocks releasing of acetylcholine on presynaptic cholinergic terminal of autonomic nerves of neuromuscular junction [2]. During the disease, botulinum toxin is accumulated in the nerve tissues from blood which affect muscle nerve junction [1].

Water Borne Diseases

Cholera is a waterborne disease, which is caused by bacterium *Vibrio cholerae*. The spreading of this disease is mainly through contaminated drinking water. The symptom of this disease is severe, acute watery diarrhea and vomiting, which can rapidly lead to dehydration and if untreated it may lead to death [3]. Inadequate water supplies, poor sanitation and poor hygienic conditions are mainly responsible for the cause and rapid spreading of cholera diarrhea [4]. Cholera remains a major public health problem in many underdeveloped or countries with poor access to safe drinking water and proper sanitation [5].

Typhoid is an acute systemic disease of *Salmonella typhi*, which used to be transmitted by the fecal-oral route through contaminated food and water [6]. *Salmonella* species are facultative gram negative bacteria which can survive through certain stages of host parasite interaction [7]. The predominant symptoms include headache, epigastric pain, nausea, and anorexia, together with fever from the afternoon to night [8].

Polio is a communicable disease spreads through human-to-human contact, generally entering the body through oral route due to fecal contaminated food or water, causing paralysis of essential muscles, which usually controls the swallowing, heartbeat, and respiration [9]. Silent poliovirus circulation can be detected by sewage surveillance before appearance of the first case of irreversible poliomyelitis [10].

Global polio eradication was initiated in 1988. Oral polio vaccine (OPV) and inactivated polio vaccine (IPV) were available [11]. Poliovirus is detected in the faecal matter of humans for many months after OPV vaccination [12]. There is 95% reduction of poliomyelitis cases from 388 to 62 in 2009 and cVDPV2 declined by 82% in 2011 from 154 to 35 [13]. Polio eradication initiative, an estimated 250,000 children are now alive and another 5 million children are walking who otherwise would have been paralyzed [14]. Many regions and communities have ceased to worry about polio [15].

Air Borne Diseases

Diseases spread through air are commonly known as air borne diseases and some of the air borne ancient diseases includes anthrax, influenza, measles, smallpox and tuberculosis. Anthrax is an air borne disease, which spreads mainly through inhalation of air. Anthrax is a serious bacterial infection of humans and many animal species caused by *Bacillus anthracis*. Effective prophylaxis and treatment of anthrax remain a challenging task in spite of the modern advances in the antimicrobial therapies and vaccines [16]. We can find this bacterium worldwide, mainly existing in the soil in the form of resistant spores [17]. *Bacillus anthracis* is a rod-shaped, Gram-positive bacterium, which form endospores that survive in harsh conditions. Illness occurs after secretion of two toxins, lethal toxin (LeTx) and edema toxin (EdTx) [18].

Influenza (H1N1) is a highly contagious respiratory pathogen that continues to evolve and threaten both veterinary and human health [19]. It is an important pathogen causing disease in the birds and further transmits to humans globally. The genome of Influenza virus encodes highly conserved nonstructural gene (NS1), which is thermodynamically stable [20]. Influenza is an extremely variable, fast-mutating virus. It is basically classified as Influenza virus A, Influenza virus B, and Influenza virus C. Although these three viruses seem to be related to each other, they have different disease characteristics [21]. Annual epidemics result in approximately three to five million cases of severe illness, and about 250,000 to 500,000 deaths. Influenza vaccination of healthcare workers (HCWs) is a critically important step to substantially reduce healthcare associated influenza infections [22].

Measles is a highly contagious and infectious disease of children, spreads through respiration [23,24]. Measles virus (MV) is a member of the paramyxovirus family of enveloped RNA viruses [25]. The main manifestation of measles is fever and skin eruption and may mimic many diseases [26]. However, measles eradication seems more complex, since it requires very high immunization coverage, almost 100% among target susceptible individuals [27].

Smallpox is caused by either of two virus variants, *Variola major* and *Variola minor* (VARV), both members of the poxviridae family. The noun "smallpox" arose in the 15th century [28]. It is an infectious disease that has killed more people worldwide than almost any other single pathogen [29]. The respiratory tract is the usual route of entry for smallpox. Smallpox is a member of the family Poxviridae, subfamily Chordopoxvirinae, and genus orthopox virus. Poxviruses are linear, single, double-stranded DNA viruses, which will cause disease in humans, such as smallpox, monkeypox, etc. As smallpox lacks a known non-human animal reservoir, its origin as a human pathogen is still ambiguous [30]. Many of the orthopox viruses have a high degree of homology with the smallpox virus (e.g. monkey pox virus has a 96.3% homology but it is unclear how many mutations

would be required to produce a strain that could cause similar clinical symptoms [31].

Tuberculosis (TB) is the most common and deadly infectious disease associated with significant mortality and morbidity. *Mycobacterium tuberculosis* is the causative agent of TB, which is transmitted through aerosol droplets that are deposited in the lungs which become the reservoir of infection [32]. This infection initially occurs in the upper part of the lungs [33] and causes pulmonary tuberculosis, as well affect meninges, intestine, lymph nodes, bone, joints, skin and other tissues of the body [34]. One-third of the world's population has latent-TB, a condition in which mycobacteria can survive within a host for years without causing disease [35]. Tuberculosis remains one of the world's top ten leading causes of death [36]. Increase in drug-resistant strains of tuberculosis has emphasized the need for better treatments and vaccines for the disease [37].

Vector Borne Diseases

Diseases spread through vectors are commonly known as vector borne diseases and some of the vector borne ancient diseases includes dengue, plague, malaria, chikungunya, etc. The dengue fever is one of the life threatening diseases caused by dengue virus (Flavivirus) that is borne and transmitted by mosquitoes [38]. Dengue viruses (DENV1-4) are estimated to infect 50-100 million individuals per year worldwide including an estimated 500,000 people with dengue requires hospitalization every year [39].

Dengue is a RNA virus belongs to the family flaviviridae [40]. Dengue hemorrhagic fever (DHF) is the severe form of dengue infection, possibly inducing hypovolemic shock, known as dengue shock syndrome (DSS) [41]. Typical features of dengue fever include headache, arthralgia (break-bone fever), thrombocytopenia, fever, vomiting. A typical fine measles like rashes with petechial spots are classical and can be precipitated with a tourniquet test [42]. Neurologic manifestations, other than headache, occur in approximately 4-6% of dengue cases [43].

Plague is a zoonotic disease caused by Gram-negative bacterium *Yersinia pestis*, which is usually transmitted to humans from infected rodents via the bite of an infected flea. Historically, plague has been an awful infectious disease afflicting human populations, leading to millions of deaths [44]. *Yersinia pestis* infection most commonly can manifest itself in three different fashions, namely Bubonic plague, Septicemic plague and Pneumonic plague. Signs of illness expected would be fever with cough and production of watery, bloody, or purulent sputum, and nausea, dyspnea, vomiting, abdominal pain, and diarrhea may also be present [45].

Malaria is one of the most common parasitic diseases in the world, leading to over a million deaths/year. This is an antroponotic disease caused by four Plasmodium species. These parasites were circulated among humans by different vectors around the world [46]. The most virulent among the human malaria parasites is *Plasmodium falciparum* (Pf), Symptoms of uncomplicated malaria include fever, headache and vomiting [47].

Rabies is an important international viral zoonotic disease that causes an acute encephalitis not only in a variety of animal species but also in humans [48,49]. The disease is caused by single-stranded negative-sense RNA viruses from the genus *Lyssa virus*, and belongs to the family Rhabdoviridae [50,51]. Vaccination against rabies is unique

in that it is used post-exposure to prevent disease [52]. Over the years, several types of anti-rabies vaccines have been produced developed used to protect man and animals against rabies [53].

Conclusion

There is significant impact of microbes on ancient diseases, which are cured after the discovery of many potent natural compounds, vaccines, antibiotics and other alternatives. Although, we succeeded in curing these ancient diseases, by potent medicines, antibiotics and vaccines, microbes are emerging day by day by showing mutations due to adverse chemical genotoxicity resulting in resistance to drugs, becoming an ever green challenge to the scientific community.

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