

EDITORIAL

ZOO NOTIC DISEASES

Zoonotic diseases (zoonoses) are infectious diseases of vertebrate animals that can be transmitted to humans. The causative agents are bacteria, fungi, protozoan parasites and viruses. Typical examples are anthrax, leptospirosis, bovine spongiform encephalopathy (BSE, mad cow disease), brucellosis, bovine tuberculosis, bubonic plague, taeniasis, trypanosomiasis, viral haemorrhagic fevers, rabies and influenza. It is thought that many modern epidemic diseases started out as zoonoses. This possibility is supported by evidence based on DNA and RNA sequencing. These include diseases such as measles, smallpox, human immunodeficiency virus (HIV) and diphtheria. Many types of "common cold" and tuberculosis are adaptations of strains originating from other animal species. Similarly, swine flu (H1N1) and avian flu (H5N1) have spilled over to human population even though on a limited scale. An observation by Dr. Jenner in 1798 that dairy workers exposed to cows infected by cowpox were immune to smallpox supports this theory. The HIV-1 that causes acquired immune deficiency syndrome is related to simian immunodeficiency virus found in chimpanzees. A brief description of some of the notable zoonotic diseases follows.

Anthrax is caused by *Bacillus anthracis*. It causes high mortality in animals and humans. Some form of the disease respond well to antibiotics. An effective vaccine for animals is available. The disease is spread by spores. Meat from infected animals can spread spores. Thus, it is recommended that animals that die from anthrax be incinerated without being skinned or buried six feet deep in the ground. Due to the ability of the spores to persist in the environment and ease of their production, the potential use of *B. anthracis* in biological warfare is well recognized. Bovine spongiform encephalopathy is a fatal neurodegenerative disease transmitted to humans through ingestion of meat from infected animals. The most recent outbreak of BSE occurred in the United Kingdom (UK) in 2009 and killed 177 people. By the time it was detected, approximately 480,000 BSE infected animals had entered the food chain. This led to a ban on meat importation in several countries with disastrous economic consequences in the UK.

Brucellosis is a highly contagious zoonosis transmitted to humans through ingestion of unpasteurized milk or undercooked meat from infected animals. It is caused by small Gram-negative, non-motile, non-spore-forming rod-shaped coccobacilli of the *Brucella* genus. Common symptoms include profuse sweating and joint muscle pain. Because it is rare, diagnosis is a problem and often clinicians mistake it for malaria. Treatment with antibiotics is effective. Similarly, bovine tuberculosis is transmitted to humans when they drink milk from infected cows. It can also be spread through air. Bubonic plague is yet another bacterial zoonosis. It is caused by *Yersinia pestis* which is transmitted to humans through bites of infected flea. The disease circulates in rodents (rats) reservoir from which the fleas transmit it to humans. There is also indication that it can be spread by air, direct contact and food. Nevertheless, recent studies based on computer simulation suggest that rats were in fact victims rather than vectors of bubonic plague.

Taeniasis best exemplifies zoonoses of protozoan origin. It is caused by two tapeworm species, namely *Taeniasaginata* and *T. solium*. Humans are infected when they eat undercooked meat infected with cysts. Fortunately, there are effective anthelmintics (such as praziquantel and niclosamide) for the treatment of taeniasis. Nevertheless, control measures emphasis on public health interventions involving proper disposal of human waste.

Viral haemorrhagic fevers (VHF) are caused by four families of viruses, namely Ebola, Marburg, yellow fever and Lassa fever viruses. They damage blood vessels and affect the immune system. Ebola is

transmitted to humans from wild animals but is spread through human to human contact. It has a very high fatality and kills approximately 50% of those infected. The first case of Ebola occurred in Central Africa in 1976, while the latest epidemic has been ravaging West Africa since late 2013 with Liberia, Sierra Leone and Guinea accounting for the highest number of casualties. So far, five species of Ebola have been characterized. These are Zaire, Bundibugyo, Sudan, Reston and Tai Forest species. The current one in West Africa is due to the Zaire species.

Rabies, a viral disease that causes acute inflammation of brain in humans is transmitted to humans through bites or scratches from infected animals (usually dogs). In America, rabies virus is transmitted to humans through bat bites. Swine flu and avian flu are typical influenza viruses which mutated and were transmitted to humans. The first swine flu was observed in Mexico in 2009. Transmission occurs through inhalation or ingestion of droplets containing viral particles from the sneeze or cough of infected persons. Avian flu has been spreading in Asia since 2003 and reached Europe in 2005 and Middle East in 2006. In January 2012, China reported its second death from avian flu following other fatalities in Vietnam and Cambodia.

A review of literature shows that the mode of transmission of zoonoses from animals to humans and even human to human is poorly understood. A case in point is Ebola where even medical specialists have contracted the disease while treating patients. In the case of swine and avian flu, the mode of transmission is poorly documented making public health intervention measures unsatisfactory. To compound the situation, many zoonotic diseases are epizootic, meaning that they appear as new cases in a given animal population at a rate that exceeds what is expected. Thus it is common to have anthrax outbreak in cows in a localized area which peters out even without any intervention. Another compounding factor is the rapid mutation of viruses. For example, swine flu (H1N1) mutated to other mutants such as H3N2V, and the same is happening in the case of Ebola. It is noteworthy to point out that since viral chemotherapy at the clinical level is generally unsatisfactory, mutation of viruses is of little significance unless the new mutants are more virulent and/or more infectious.

Prof. CharlesK. Maitai,
Editor-in-Chief.