Impacts of Wildlife Infections on Human and Livestock Health

Background

- Human, domestic animal, and wildlife medicine are usually viewed as separate regulations; however, this difference is largely unrelated in the field of epidemiology, because many pathogens are generalists, infecting multiple host species.

- The majority of human pathogens (62%) also infect animal hosts and nearly half (44%) are also known to infect wildlife.

- Similarly, most of the pathogens that have caused recent epidemics in wildlife infect a wide range of hosts.

- Particular concern for ecologists is the ability of these generalist pathogens to spill over from more abundant reservoir hosts (e.g., domestic animals) to infect small, vulnerable wildlife populations.

- In terms of wildlife management and infectious diseases, the focus of concern in recent years has been the direct threat of disease epidemics to the survival and health of endangered wildlife populations.

- However wildlife infections have far-ranging impacts that extend beyond these direct disease threats to cover issues relating to public health, livestock production, and countryside livings, each of which has important consequences for wildlife management.

Wildlife infections and livestock health

- As is the case with emerging human diseases, the ability of pathogens to infect wildlife hosts is a significant risk factor for the emergence of livestock diseases.

- Interactions between domestic livestock and wildlife populations are a key issue in livestock economies worldwide, and in East and southern Africa in particular, where many communities live in close contact with wildlife.

- The establishment of effective veterinary services has the potential to improve countryside trades and reduce demand for wild animal products and thus illegal hunting activities.

Classification of animal diseases:

1. Indigenous disease:
   These are endemic to the country or region and are generally maintained in the livestock herds and/or free-ranging wildlife population.

   FMD
   African swine fever
   Classical swine fever
   Theileriosis

2. Alien/ exotic diseases: which have been introduced into a country or region, usually from the importation of infected animal or animal products.

- Canine distemper
- Bovine tuberculosis
- West Nile virus……etc.

3. Emerging disease:

1. **Recently detected diseases:**

- Parafilariasis in buffaloes

- Feline immunodeficiency virus infection in free-ranging cats.

2. **Diseases that have been recently crossed the species barrier**

- Canine distemper in free-ranging lions

- Encephalomyocarditis in free-ranging African elephant.

Bovine tuberculosis in free-ranging carnivores

3. **Truly novel disease is a chronic wasting disease**

- Transmissible spongiform encephalopathy

Disease Transmission

The transmission of infection between wildlife and livestock may occur in different ways depending on the infectious agents involving and / or the presence of a biological or mechanical vector in the epidemiological cycle.

1. Aerosols, contamination of feed and water range as: FMD, anthrax, rinderpest, encephalomyocarditis, bovine tuberculosis, canine distemper, bovine malignant catarrhal fever (BMC).

2. A flightless vector: Tick-borne Protozoal and ricketsial diseases, African swine fever.

3. A winged vector:

a. Biological transmission as Trypanosomiasis, Orb virus and Phlebovirus infections.

b. Mechanical transmission as Anthrax, Parafilariasis

Factors influence changes in wildlife disease incidence:

1. Economic Factors

- Closer interaction between man and his livestock and wild animal reservoirs has led to increased incidence of infections affecting man and livestock.

- Forest clearances have resulted in an increase in contact between humans and forest-home animals.

- Movement of animals or animal products can result in transmission of agents such as African and Classical Swine Fevers in adding on to Foot and Mouth Disease.

2. Climatic Factors

- Changing climate, e.g. periods of drought or flooding, affects disease incidence by alterations in land use or altered livestock rearing practices

- Movement or changes in distribution of animal reservoirs or insect vectors. The latter may be able to survive gradually more in northerly areas.

For example: Local increases in mosquito numbers have increased the risk of spread or introduction of disease such as:

Bluetongue (BTV)

African Horse Sickness

West Nile virus2.

- The higher temperature during the summer has also allowed previously unrecognized insect vector species to support virus replication and consequently to transmit the disease.

3. Microbiological Factors

- Pathogen evolution may occur in response to changes of which man is not aware.

- Since evolution takes place at a greater rate in RNA than in DNA viruses, the risk of the development of H5N1 influenza virus adapted to man is of particular current concern with the associated risk of potential pandemic capabilities.

- Thus, reduced population sizes can twist the distribution of resistance phenotypes to a pattern where the predominant phenotype is highly susceptible with effects both on disease and on transmission to man and livestock.

Indirect effects: the example of wildlife tourism

- A further consequence of wildlife involvement in human diseases is the potential threat to the wildlife tourism industry.

- The economic damage caused by a decline in visitors to countries suffering from infectious diseases highlights this potential threat.

Surveillance for wildlife disease investigation , detection and diagnosis at the wildlife/livestock interface

a. Detection

The responsibility for disease surveillance in domestic livestock generally rests with the veterinary regulatory authorities of a given country, and the surveillance techniques used which include:

1. Passive reporting.

2. Farm investigation.

3. Problem investigations.

4. Abattoir surveys.

5. Serological surveys.

6. Dedicated testing for specific disease eradication schemes.

Generally, surveillance techniques should thus be structured to maximize information gained from the limited availability of carcasses or captured animals, which mostly reported by veterinary and wildlife management authorities, private and community-based approaches.

Examples of various surveillance techniques that can be applied are as follows;

A) Direct surveillance:

1- Active investigation of any reports of abnormal clinical signs or mortalities in a given geographical area as example if anthrax is suspected, trained staff collect blood smears and fill in simple data sheets.

2- Diagnostic necropsies on all carcasses that become available such as collection of road kills or examining hunter kills can increase the number of carcasses examined.

3- Veterinary and veterinary public health inspections at all lethal wildlife population management (culling) operations, as well as livestock slaughter premises in the interface area.

4- Veterinary supervision of protected area systems for disease monitoring.

5- Veterinary examination of all animals captured for any reason at all.

6- Veterinary supervision at all wild animal holding or those in captivity e.g., in the zoo.

7- Sample collection, including body fluids, tissues and excretion should be examined. Sera-surveys are also an excellent surveillance technique.

B) Indirect surveillance

1. Rodent trapping for serological surveys

2. Vector trapping for distribution studies

B). Diagnosis:

1- Conformational in a single animal e.g., rabies fluorescent antibody or immune-peroxidase tests, whereas others should only be considered.

2- Herd level tests e.g., the bovine tuberculosis comparative intradermal tuberculin test. Or blood-base gamma interferon test.

3- Repeat testing to determine sere-stability is also important, particularly in a closed herd or quarantine situation.

4- Serial sampling is also valuable for detecting parasitic conditions where intermittent shedding of ova or oocysts occurs.

5- Pooled sampling may also be used to increase diagnostic sensitivity in a group of animals that are intermittent shedders.

Disease management at the wildlife / livestock interface:

While short and medium term disease control and long-term eradication goals can and have been attained in domestic livestock using:

- Vaccination progmmes.

- Vector control

Test and slaughter polices

These options and techniques are frequently impractical or difficult and may be culturally unacceptable in free-ranging livestock and wildlife populations but applied on wildlife in captivity.

Preventive and control measures against the transmission of diseases from wildlife

A- When dealing with the threat of certain endemic African diseases such as FMD, African swine fever and theileriosis, through control zones / areas, game-proof fences, and cordons and movement control, which separate the wildlife from domestic livestock, thus effectively, blocking the interface.

B- When dealing with endemic arthropod-borne infections such as trypanosomiasis, epizootic haemorrhagic disease, African horse sickness and rift valley fever and blue tongue.

-Vaccination.

-Vector control may be included to reduce transmission.

c. The control of the multi-species diseases) such as anthrax) rabies outbreaks in wildlife are applied using various techniques including: -

1. Burning / burying of carcasses.

2. Water disinfection.

3. On the other hand, mass vaccination of foxes against rabies using oral bait techniques, has been effective and successful.

E- When dealing with an alien disease that has become endemic in free ranging wildlife, the following factors must be taken into consideration and the necessary information must be gathered prior to deciding control options:

1. Determines the spatial distribution of the disease.

2. Identifies the major maintenance host.

3. Determines the prevalence rate in maintenance host.

4. Identify transmitting hosts (vector and biological agents).

5. Identifies transmission modes.

6. Identifies human activities that may increase transmission rates such as baiting and winter-feeding.

7. Evaluates ante-mortem diagnostic tests in wildlife.

8. Explores the vaccine option.

9. Identifies any natural physical barriers to movement of hosts or disease, such as large mountain ranges, large bodies of water, deserts or forests.

With this information available, control options may be evaluated.

These options may be include the following:

1- Inhibition (short to medium term) by creation of barriers between Infected and non-infected populations (e.g., double fences or maintenance host / depopulation zones).

2- Control (medium-term) may require population management when dealing with density-dependent disease. This may include:

- Depopulation of high prevalence herds.

- Test and slaughter in low prevalence herds to reduce overall prevalence and environmental contamination when dealing with herd animals.

- Effective and safe vaccine would also be valuable and popular control tool.

3. Eradication is long-term objective and may require the continued application of the containment and control measures, maintained by major depopulation of persistent foci and problem herds.