Avian tuberculosis

Wetlands supporting groups of susceptible animals

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: Avian mycobacteriosis, avian TB, mycobacteriosis, *Mycobacterium avium* complex (MAC) disease, *M. avium intracellulare* (MAI) disease

KEY FACTS

What is avian tuberculosis?

Avian tuberculosis (avian TB) is an insidious, slowly developing, chronic bacterial disease of birds, usually affecting older individuals. The causative organism and its relatives are also capable of causing disease in a wide range of other non-avian taxa.

Causal agent

Mycobacterium avium complex (MAC) contains several subspecies including *Mycobacterium avium avium*, (often simply called *M. avium*), which is the principle cause of avian tuberculosis in wild, domestic and captive birds. However, a number of other species of mycobacteria may be involved such as the closely related *M. intracellulare,* or other species such as *M. genavense* (now realised to be relatively common in zoo and pet birds and clinically indistinguishable from *M. avium* infection). In general, *M. avium* should be seen as a slow growing, persistent, environmental organism with many related strains of which only some prove to be pathogenic.

Species affected

The disease has been found in a wide range of avian hosts but is most commonly reported in wild waterbirds, gregarious birds, raptors and scavengers, and those associated with agricultural premises.

The disease can be relatively common in poultry where densities of birds are high, hygiene poor, and older stock are retained. The culling of poultry in commercial industrial flocks at a young age has all but eradicated the disease from these units.

M. avium is also capable of infecting a wide range of mammals, both domestic and wild, including humans, pigs, sheep, mustelids, cervids and bovids. However, clinical disease is uncommon and may be associated with host immunocompromise.

Exposure to mycobacteria in the *M. avium* complex is of importance in cattle, where sensitisation may affect tuberculin skin test results. Hence, in many regions where skin testing is used for bovine TB diagnosis, it is typical to use separate avian and bovine tuberculins to distinguish between infection with *M. bovis* and mere sensitisation to *M. avium* complex .

Interestingly, *Mycobacterium avium* subspecies *paratuberculosis* (also known as MAP) is the causative agent of paratuberculosis or Johne's disease, a chronic enteritic disease of adult cattle, sheep and goats.

Geographic distribution

Reported from around the globe, and for practical purposes it can be considered to have a worldwide distribution.

Environment

The causative bacteria can live in the environment and tend to prefer damp areas with low pH. High levels of UV radiation will kill the bacteria and the majority of reports are from temperate zones rather than hot arid areas.

TRANSMISSION AND SPREAD

Vector(s)

Infected individuals provide the greatest single source of infection, however, the causative organisms are tenacious and can be carried in mud and faeces on fomites such as shoes, tyres *etc*.

How is the disease transmitted to animals?

The most common route of infection is ingestion and large numbers of bacilli may be shed in faeces from ulcerated intestinal lesions, thus contaminating the environment. High densities of animals lead to build up of faecal material providing ideal conditions for the transmission of infection.

Aerosol inhalation either from a contaminated environment, or directly from lesions in the respiratory tract of infected birds, has been suggested as the cause of pulmonary infections in domestic or captive birds, but this is relatively unusual.

Infection from an infected bird to young *via* the egg is also thought to be very unusual, and for practical purposes eggs can be seen as a good way to introduce avian TB-free birds.

How does the disease spread between groups of animals?

Close proximity of susceptible groups of animals such as pigs and poultry allows disease transfer and the feeding of poultry manure to domestic mammals provides a means for transmission of infection.

Raptors and scavenging birds may also be infected by consuming infected prey.

How is the disease transmitted to humans?

Humans are generally very resistant to *M. avium* infection, however, where there is an underlying chronic lung condition or immunocompromise, humans may be at risk. *M. avium* is a common infection in people with HIV/AIDS in the developed world however these infections are thought to be mainly environmental strains of *M. avium* rather than those of animal origin.

IDENTIFICATION AND RESPONSE

Field signs

In birds there are generally few specific signs of avian tuberculosis. Most typically there is chronic wasting with birds becoming emaciated often exhibiting a prominent keel. Birds are usually weak and lethargic, often with poor or ruffled plumage. In late stages of the disease, abdominal distension as a result of liver enlargement and a build up of ascitic fluid can give an emaciated bird an unusual 'bottom heavy' appearance. Lameness is relatively common if there is bone involvement. Diarrhoea is common whether chronic or intermittent. Ceres and other areas of exposed skin may become progressively paler as the disease progresses. Respiratory involvement is relatively unusual but this may result in wheezing. Alternatively birds may just be found dead or succumb to another cause of death before these clinical signs are apparent.

In cattle, *M. avium* complex infection is an uncommon cause of disease, but may cause localised abscesses or mastitis. Johne's disease often presents as progressive weight loss and reduced milk production.

In deer, *M. avium* complex infection may cause progressive weight loss, emaciation and diarrhoea.

In pigs, there are generally no obvious signs of disease with evidence of infection being found at slaughter in either or both the lymph nodes around the neck or those draining the intestine.

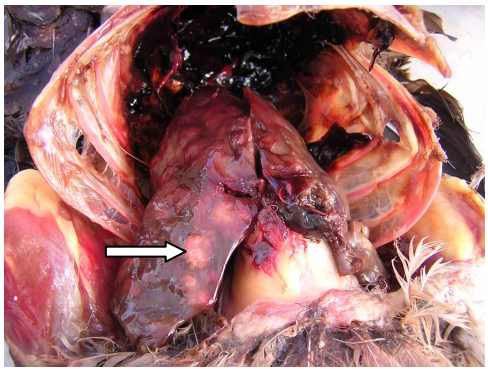
Recommended action if suspected

The disease is not notifiable to the OIE but prevention of establishment of the disease is highly desirable as control thereafter is complex and often unsuccessful. ► **Prevention and control in wetlands below.**

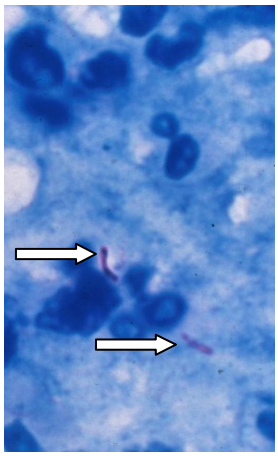
Diagnosis

In live birds the disease is difficult to diagnose, and diagnosis relies on a combination of laboratory tests such as abnormal blood cell counts and/or finding bacteria in the faeces. More often the diagnosis is reached at *post mortem* examination, based on the presence of acid-fast bacilli within tuberculous granulomatous lesions in affected tissues. Microscopy using a modified Ziehl Neelsen stain (see images below), or further laboratory tests (*e.g.* molecular probes), are necessary to confirm the presence of the causative bacilli. A whole bird carcase is ideally required for *post mortem* examination. When this is not possible, the liver, kidneys and intestines or any other obviously affected tissues should be submitted to the diagnostic laboratory.

Similarly, in mammals, diagnosis is often made at *post mortem* examination.



At *post mortem* examination a shot pink-footed goose *Anser brachyrhynchus* is found to have typical tuberculous lesions in its liver.



In a stained slide of a smear from the liver lesions, the causative bacteria show up as pink rods.

PREVENTION AND CONTROL IN WETLANDS

Environment

For domestic stock, maintaining **high standards of hygiene** by good cleansing and disinfection helps to minimise spread of *M. avium,* although it is important to note that the bacteria have a tough cell wall which makes them resistant to many disinfectants.

The bacteria prefer a low **pH** and increasing this may help reduce environmental contamination *e.g.* by the addition of lime (noting that changing pH will affect vegetation and associated invertebrate communities also). **Cutting back vegetation** and **turning soil** to expose it to UV radiation will help to reduce environmental contamination.

Livestock	Action should be directed firstly towards preventing the introduction of infection, as subsequent control can be very difficult. Good biosecurity practices will help to reduce risk of introducing *M. avium,* including purchasing animals/eggs from known avian TB-free stock. Good surveillance ensures any problems can be dealt with quickly before infection becomes established. Diagnosis of the disease in poultry ideally should prompt a policy of culling of the flock. In addition, cleansing and disinfection is important, as subclinically infected animals and environmental contamination may result in the disease becoming endemic. For poultry, keeping the **age structure** young and slaughtering early provides a powerful means by which to control the disease. The disease is often slow to progress and con-current infections or stress can allow activation or reactivation of subclinical infection, hence efforts should be made to reduce both of these contributory factors.
Wildlife	Contact with domestic/captive birds should be avoided. **High densities of wildlife** represent a risk factor for this disease and practices such as supplemental feeding of wildlife can contribute to this risk. As for poultry, **stress** may play an important role in allowing a subclinical infection to develop into full-blown disease hence efforts should be made to mitigate against other stressors such as poor nutrition, pollution, con-current infections, disturbance *etc*.
Humans	General standards of **personal hygiene** are sufficient to reduce risk to most humans in and around wetlands and infected animals.

IMPORTANCE

Effect on wildlife	In most situations, the disease is likely to have relatively limited impact on wildlife other than as an occasional cause of death. However, it has been a problem for several threatened species such as the whooping crane *Grus americana* in North America, and the lesser flamingo *Phoeniconaias minor* in east Africa. It can be a problem where wild birds are attracted to wetlands where infected captive birds are maintained. Overall, efforts should be made to prevent infection becoming established in wild populations.
Effect on livestock	The greatest impact is on poultry flocks where control actions involve culling.
Effect on humans	Public health concerns are relatively limited although care should be taken if it is known that infection is present, to reduce potential for opportunist infections. High risk (*e.g.* immunocompromised) individuals should take extra precautions in such situations.
Economic importance	Where the disease is diagnosed in industrial units, and culling, cleansing and disinfection measures are required, economic losses can be significant. Within smaller flocks the loss of production and general unthriftiness of animals is of importance.

FURTHER INFORMATION

Useful publications and websites (Avian TB)

- Friend, M. & Franson, J.C. (2001). **Avian tuberculosis**. In: Field manual of wildlife diseases: general field procedures and diseases of birds. E. A. Ciganovich (ed.). pp 93-98. U.S. Department of the Interior and U.S. Geological Survey, Washington, DC. www.nwhc.usgs.gov/publications/field_manual/chapter_8.pdf [Accessed March 2012].
- World Organisation of Animal Health (OIE). **Chapter 2.03.06: Avian tuberculosis**. Manual of diagnostic tests and vaccines for terrestrial animals. www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.03.06_AVIAN_TB.pdf [Accessed March 2012].
- Tell, L.A., Woods, L. & Cromie R.L. (2001). **Mycobacteriosis in birds**. *Revue Scientifique et Technique de l'Office International des Epizooties*, 20, 180–203.
- Thorel, M.-F., Huchzermeyer, H.F. & Michel, A.L. (2001). ***Mycobacterium avium* and *Mycobacterium intracellulare* infection in mammals**. *Revue Scientifique et Technique de l'Office International des Epizooties*, 20, 204-218.
- Merck & Co. Inc. **The Merck veterinary manual: tuberculosis**. www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/204400.htm&word=avian%2ctuberculosis [Accessed March 2012].
- Wildpro. **Avian tuberculosis**. http://wildpro.twycrosszoo.org/S/00dis/Bacterial/Avian_Tuberculosis.htm [Accessed March 2012].

Useful publications and websites (Johne's Disease, paratuberculosis)

- European Association of Zoo and Wildlife Veterinarians. **Johne's Disease**. http://www.eaza.net/activities/tdfactsheets/091%20Paratuberculosis%20Or%20Johne%20s%20Disease.doc.pdf [Accessed March 2012].
- Centre for Food Security and Public Health (CFSPH). **Johne's Disease Factsheet**. www.cfsph.iastate.edu/Factsheets/pdfs/paratuberculosis.pdf [Accessed March 2012].