

Acute systemic types fish disease:

Mycobacteriosis (Fish TB)

Chronic, systemic bacterial infections by various *Mycobacterium* species are frequently diagnosed in aquarium fishes. The species most commonly found in fishes are *M. marinum*, *M. abscessus*, *M. chelonae*, and *M. fortuitum*. These species, as well as *M. peregrinum* and *M. haemophilum*, have been associated with mycobacteriosis in zebrafish .

Usually mycobacteriosis is chronic with low level mortality, but in certain circumstances, infections may be very acute and result in severe epizootics in zebrafish colonies. Factors that are most responsible for the differences seen in the severity of outbreaks in fish mycobacteriosis have yet to be determined. It is not know if highly virulent strains or species cause the acute outbreaks, or if the outbreaks occur in fish that are immunocompromised by other factors, such at poor water quality, excessive crowding and handling, etc.

Mycobacterium spp. of fishes can infect humans. In most cases, the infections are confined to the extremities, and though not usually life-threatening may require aggressive antibiotic treatments to resolve (Kern et al. ; Shih *et al* .

However, these infections may be lethal to immune compromised individuals. Considering the zoonotic potential of *Mycobacterium spp.* from fishes, those handling aquarium fishes, including zebrafish, should wash their hands after coming in contact with water containing fish, and avoid exposing open lesions to aquarium water and fishes. Most cases of human mycobacteriosis associated with fishes are caused by *M. marinum*. This species is considered not to grow, or to grow very poorly, at 37 C. The majority of *M. marinum* cases are not life threatening and are confined to extremities, where body temperatures are lower. However, some strains of *M. marinum* are capable of growth in culture at 37 C, and we demonstrated that others not capable of growth at this temperature in media can grow at 37 C in macrophage cell lines and in mice.

Clinical Signs and Gross Pathology

Clinical and macroscopic changes associated with *Mycobacterium* may be variable, dependent upon the site and extent of the infection, and on the “chronicity” of the infection. Clinical signs include lethargy, anorexia, and emaciation. Fish may exhibit ulcers, hemorrhage or hyperemia around the head (similar to Gram negative septicemia), raised scales, frayed fins, and pallor of the skin or gills. A hallmark macroscopic change is the presence of multiple, white nodules in various visceral organs. These are visible by close examination of organs with a dissecting microscope, but may be hard to find in small fish, such as zebrafish.

Diagnosis

Preliminary diagnosis is achieved by observing multiple granulomas in visceral organs in either wet mounts or histological sections. These may also be caused by fungal or parasitic infections. Confirmatory diagnosis is requires visualization of acid fast bacilli in either histological sections or in tissue imprints. Often zebrafish are decalcified during processing for histology, and we recently found that certain aggressive decalcification procedures may inhibit the acid-fast staining of *Mycobacterium spp.* in tissue sections.

Some *Mycobacterium* species are relatively difficult to grow in culture, and thus this procedure is infrequently employed with fish. PCR tests for screenings for the presence of the causative agent have been described. Such tests, while extremely sensitive, usually do not provide information on disease status or the severity of infection, but may be useful for screening for carrier/subclinical infections. We have also used PCR tests to obtain mycobacteria sequence directly from infected fish, which is very useful for species identification of bacteria that are difficult to grow in culture.

Control and Treatment

The infection is usually very difficult to eradicate in fish culture systems with antibiotics. However, Conroy and Conroy reported that kanamycin at 50 ppm with 4 doses 2 days apart apparently controlled the disease in guppies. Boos et al. treated firemouth cichlids and Congo tetras orally with rifampicin and tetracycline with some success. Nevertheless, depopulation of affected tanks and avoiding cross contamination has been the most effective way for controlling the infection in aquarium fishes. Because the disease is rather insidious, the infection is wide spread in aquarium fishes, and treatment with antibiotics is difficult, the best approach is to avoid the infection. This is accomplished by strict quarantine procedures and understanding a thorough history of the stocks introduced into research facilities. In addition, optimizing water quality and husbandry conditions will reduce the likelihood of epizootics occurring when a few carry fish are present in the population.