Guideline for medical interventions
Veterinary Medicine
Aquatic Animal Medicine

Motile Aeromonas Septicemia (MAS)

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Committee

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1-Scope

Motile Aeromonas septicemia is a global problematic septicemic bacterial disease affecting freshwater and brackish water fishes as well as it has public health hazard. *The bacterium* causes a huge fish mortalities and significant economic losses in aquaculture.

2-Summary

Aeromoniasis was the most prevalent bacterial diseases affecting freshwater and brackish fishes caused by motile aeromonads of the *Aeromonas hydrophila* complex which includes A*eromonas hydrophila, Aeromonas sobria,* and *Aeromnas veronii*. *Aeromonas hydrophila* is an opportunistic bacterium that can be transmitted to stressed fish by oral and dermal routes. The bacterium restricts fish production, harms the economy, and necessitates the use of costly control methods, making it a major barrier to the growth and sustainability of the aquaculture sector. The overuse of synthetic pharmaceuticals and antibiotics results in the emergence of drug bacterial resistant strains, as well as the buildup of drug residues in fish tissues and water that may be harmful for both the environment and humans. Moreover,

there was no commercial vaccine against MAS. Therefore, to date control of MAS has been a challenging issue.

3-Introduction

Motile Aeromonas Septicemia (MAS), hemorrhagic septicemia, ulcer disease, red-sore disease, or infectious dropsy are diseases that are caused by *A. hydrophila* complex (**Mzula et al., 2019**). The bacteria are normally inhabitant in the aquatic environment and the gastrointestinal tract of the healthy animal. Therefore, various motile aeromonads species are reported as stress related pathogen resulting in disease outbreaks and huge mortality in wild and cultured freshwater fishes (**Youssuf et al., 2020**). In addition, *A. hydrophila* has been reported in reptiles, amphibians, cattle, and humans worldwide.

The highest prevalence of aeromonas isolates from infected fishes that cause 80-100% modalities are reported to be *A. hydrophila, A. jandei* and *A. veronii* (**Abdelsalam et al., 2021**) Horizontal transmission via ingestion of contaminated food or direct contact with infected fish are the main route of MAS infection. Additionally, homologues co-infections of *Aeromonas* with other bacteria such as *A jandaei* and *A. veronii* (**Dong et al., 2017**), or heterologous co-infection as *Aeromonas* sp. and *Streptococcus sp* (**Sukenda et al., 2017**), *A. veronii* and *F*lavobacterium *columnare (***Dong et al., 2015**),** *A. hydrophila and Tilapia Lake virus* (**Nicholson et al., 2020**) are considered an important cause for enormous mortalities of tilapia farms.

In Egypt, Aeromonas species have been reported from Nile tilapia suffering from summer mortality syndromes (**Matter et al., 2018; Youssuf et al., 2020**).

4-Etiological agent

- The motile aeromonads are small Gram-negative bacilli or coccobacilli rods (~0.5 x 1µm) (fig 1), and non-spore-forming bacteria.
- It can thrive and flourish in a wide range of temperatures, reaching as high as 37 ºC.
- The virulence factors of *A. hydrophila* include haemolysin, aerolysin, cytosine, gelatinase, enterotoxin, and antimicrobial peptides.

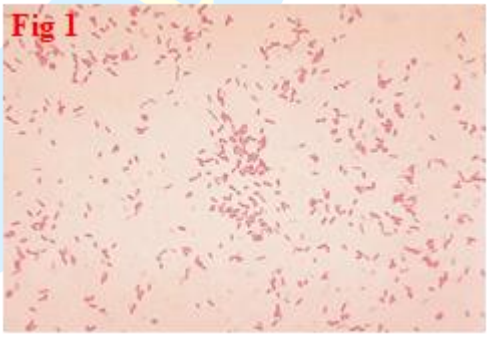
Fig 1

- MAS outbreaks are usually associated with environmental stressors that have diminished fish immunity to resist pathogen. These factors include temperature stress, stressful water quality conditions (low dissolved oxygen, high ammonia, high organic load, pollution), overcrowding, poor nutritional condition, physical injury, and infection with another bacteria, virus, parasites, or fungi (**Harikrishnan & Balasundaram, 2005**).

5-Diagnosis

a-Clinical signs and lesions

- The clinical signs vary from acute hemorrhagic septicemia to large ulcerative lesions in chronic stages depending on numerous factors such as virulence of the microorganism, fish immunity, and environmental stressors.


Fig 2

- Typical signs of septicemia include reddened fins and anal opening, generalized skin hemorrhages, exophthalmia, abdominal distension, fin erosion, and protruded scales (lepidorthosis) due to accumulated fluids in the scale pockets (edema) (Fig 2) (**Youssuf et al., 2020**).
- Chronic infections with *A. hydrophila* were associated with dermal ulcerative lesions with focal hemorrhages and inflammation.
  - **Internally,** hyperaemia of the internal organs and wall of swim-bladder, petechial haemorrhages on the liver, bloody to yellowish exudate in abdominal cavity, diffuse hemorrhages and congestion in the intestines and visceral organs, congestion of gills, grayish lesions in internal organs in chronic cases (**Aly et al., 2023).**

b- Laboratory diagnosis

- **Samples:** Gills, intestine, and visceral organs of infected fish

I- Presumptive diagnosis

Isolation and identification

- It grows rapidly on common nutrient media such as Tryptic Soya Agar (TSA) or Brain Heart Infusion agar (BHIA) at 20 to 37°C producing creamy, round, slightly raised colonies that are commonly ∞-hemolytic on blood agar. On selective media such as Rimler Shotts agar it gives yellowish to green colonies (**Shotts and Rimler, 1973**).
- The virulent *bacterial* strains are known to use myo-inositol as their only carbon source. They are also known to be oxidase positive, catalase positive, indole positive, ferment and oxidize glucose producing gas.
- API 20E and API 20NE are commercial biochemical kits used for bacterial identification.

II-Histopathological examination

- Fish infected with *Aeromonas spp* revealed degenerative and necrotic changes in tissue with inflammatory response (**Dong et al., 2017**). *A. hydrophila bacterium* produces protease, elastase, and hemolysin that cause massive necrosis in the tissue **(Yardimci and Aydin, 2011**).

III-Confirmatory diagnosis

- **Molecular assay**
  - PCR identification using sequence analysis of the 16S rRNA gene or the gyrB genes are the most common techniques for confirming the identity of motile aeromonad (**El-Gohary et al. 2020**).
  - Restriction fragment length polymorphism (RFLP)-PCR assay is also an easy technique that differentiate between the most relevant and antigenically related *Aeromonas spp* (**Algammal et al., 2020**)

6-Control of disease

- **Preventive measures**
  - *A. hydrophia* exhibits biochemical and serological heterogeneity, therefore, there are no commercial obtainable vaccines for MAS (**Pridgeon and Klesius, 2012**). However, researchers have developed vaccines from locally isolated strains such as live attenuated, formalin and autoclaved inactivated vaccine (**Youssef et al., 2023**), lipopolysaccharide vaccine (**Dehghani et al., 2012**) that showing promise protection against MAS.

- Preventive measures against MAS involve improving aquaculture management to reduce stress, tissue injuries, and prevention of parasites and other infectious agents. Effective treatment should start once a fish infection with *A. hydrophila* is confirmed (**Swann and White 1991**). Applications of bacteriophages against MAS have been reported in striped catfish (**Le et al., 2018**) and tilapia (**El-Araby et al., 2016).**
- Many herbal immunostimulants, probiotics and prebiotics have been improved fish immune system and resistance against aeromonas infection (**Abd El-latif et al., 2021**)

- **Treatment**
  - Appropriate application of antibiotics is important to treat pathogenic bacteria and minimize the development of antibiotic resistance in aquaculture. Therefore, antibiotics should only be used when the fish still feeding well, and the medicated diets must be regularly administered at the therapeutic dose for the duration of the prescribed treatment period.
  - *A. hydrophila* strains have been developed Multiple antibiotic resistance (MAR) worldwide (**Vivekanandhan et al., 2002**).
  - There are three feed-based treatments available against MAS, Terramycin® (oxytetracycline), Romet 30® (sulfadimethoxine plus ormetoprim), and Aquaflor® (florfenicol). The U.S. Food and Drug Administration has only approved Terramycin® for treatment against Aeromonas in salmonids and catfish.

- **Zoonotic importance**
  - *A. hydrophila* is a food-borne pathogen, has zoonotic importance and can be transmitted to humans via consumption of contaminated water and raw or uncooked infected aquatic products (**Yousr et al., 2007**)
  - Infection with *A. hydrophila* can result in gastrointestinal infection (watery diarrhea to dysenteric or bloody diarrhea) or non-gastrointestinal complications (hemolytic syndrome and kidney disease, bacteremia and septicemia, cellulitis, meningitis, ocular infections, pneumonia, urinary tract infection in neonates, osteomyelitis, peritonitis and acute cholecystitis (**Borger et al., 2006**).

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