

**A CASE OF *Aeromonas hydrophila* INFECTION DUE TO CAPTIVITY-INDUCED STRESS  
IN A SPECTACLED CAIMAN (*Caiman crocodilus*)**

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**ABSTRACT**

*Aeromonas hydrophila* is a facultative anaerobic, Gram-negative bacterium often regarded as an opportunistic pathogen in animals. A 4-year-old male spectacled caiman (*Caiman crocodilus*) died after 4 days of anorexia and depression. Necropsy was performed during which mild swelling and ash gray discoloration of the liver was observed. Additionally, the gall bladder was enlarged and elongated. Rod-shaped bacteria were found in the liver by Giemsa staining and identified as *A. hydrophila*. The animal had been exposed to stressful conditions prior to death, and decreased immune system functioning may have contributed to *A. hydrophila* infection of the animal.

**Key words:** Aeromonad, exhibition stress, pathology, spectacled caiman.

**INTRODUCTION**

*Aeromonas hydrophila* is a facultative anaerobic, oxidase-positive, Gram-negative bacterium that naturally inhabits aquatic environments (Park *et al.*, 2011). Aeromonads have been reported as pathogens in fish, amphibians and reptiles (Harikrishnan and Balasundaram, 2005). Infection with *Aeromonas* spp. causes hemorrhagic and ulcerative disease, furunculosis and septicemia in animals (McColl, 1983). Here, we report a rare case of *A. hydrophila* infection in a captive spectacled caiman following exposure to stress due to exhibition at a zoo. This type of stress has not been previously described as a risk factor for *Aeromonas* infection.

Case Report: A 4-year-old male spectacled caiman (*Caiman crocodilus*) had a 4-day history of anorexia and depression but did not appear to be suffering from any other conditions aside from those signs. The animal was housed in an enclosed facility at Daejeon O-World Theme Park located in the middle of Korea (36°17'N, 127°23'E), and was fed a diet of chicken and pork. The animal was treated with dexamethasone (0.25 mg/kg, Dexorone, Handong Pharmacy, Korea) and multi-vitamins (1 ml/kg, Aminolite, Boehringer Ingelheim, Germany) delivered via intramuscular injection. However, the animal was found dead following the 3-day treatment period.

A necropsy was performed according to a standard protocol, and the liver was submitted to the laboratory housed at the theme park for bacteria culturing. The carcass had a normal appearance except for abscesses that were located bilaterally in the abdominal subcutaneous areas. The trachea and stomach were empty

except for yellow-green bile. Mild swelling and ash gray discoloration of the liver was observed, and the gall bladder was enlarged and elongated (Fig. 1). Giemsa staining revealed the presence of rod-shaped organisms tinted violet in the liver parenchyma (Fig. 2).

The liver was cultured on blood agar (Asan Pharmacy, Korea) and MacConkey agar (Difco, USA) at 37°C for 18 h. A pure culture of hemolytic, milky colonies was isolated on both types of agars following the incubation period. The colonies were composed of Gram-negative coccobacillary bacteria. These microorganisms were identified as *A. hydrophila* using a biochemical API 20NE identification kit (Biomerieux, France).

**DISCUSSION**

*Aeromonas* infection in aquatic animals has been recognized for over 100 years, but is not as widely observed in other vertebrates (Harikrishnan and Balasundaram, 2005). *A. hydrophila* has been reported to cause septicemia in several types of animals (Ocholi and Spencer, 1989; Ocholi and Kalejaiye, 1990; Pasquale *et al.*, 1994; Krovacek *et al.*, 1998; Harrison *et al.*, 2001) along with mastitis, septic arthritis and abortion (Willoughby *et al.*, 1989; Duthie *et al.*, 1995).

There are a few reports of crocodiles with septicemia associated with *A. hydrophila* infection in zoos (Turutoglu *et al.*, 2005; Roh *et al.*, 2011). Furthermore, *A. hydrophila* was isolated from 85% of the oral cavities of American alligators (Gorden *et al.*, 1979). *A. hydrophila* is ubiquitous in the natural habitats of alligators and crocodiles, but does not appear to be pathogenic under normal conditions. However, stress factors such as trapping, handling and thermoregulation

may promote the rapid bacteria proliferation, thereby leading to disease development (Gorden *et al.*, 1979; Roh *et al.*, 2011).

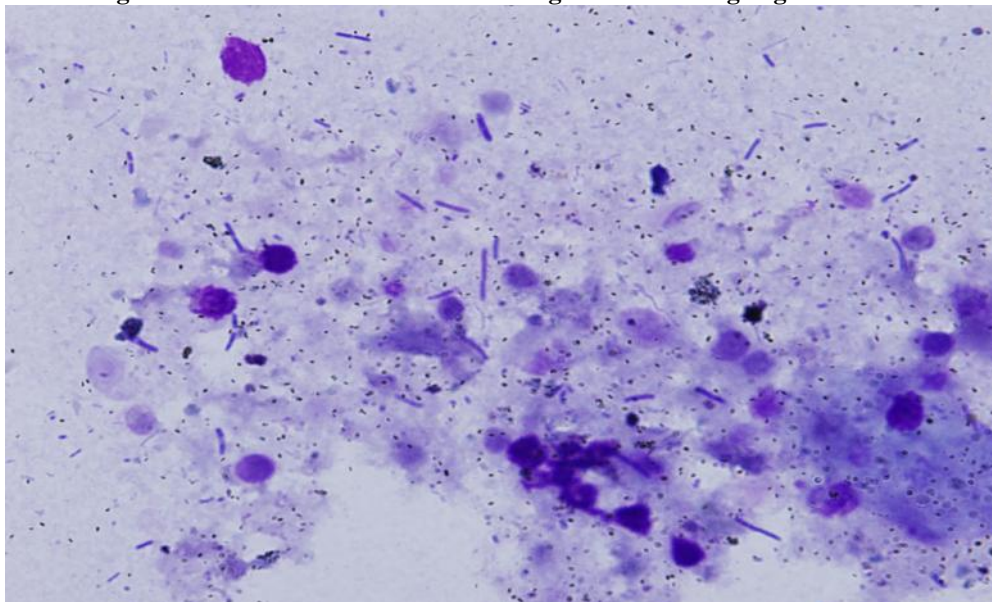
The deceased spectacled caiman described in the current case was raised and exhibited in a zoo for 3 years. The source and route of infection were not determined. However, oral infection with *A. hydrophila* may have been attributed to the consumption of contaminated food. Among the factors presented in the case history, stress caused by exhibition and captivity that decreased immune system functioning may have contributed to infection of the animal.

Our results are in agreement with those of previous studies (McColl, 1983; Rideout *et al.*, 1985; Kinney *et al.*, 1999; Dror *et al.*, 2006) showing that stress

hormones such as epinephrine and norepinephrine increase the growth and virulence of bacteria. Increased bacterial growth may alter the environment in a manner that promotes infection of an animal under stressful conditions. In particular, the small intestine is richly innervated with noradrenergic nerve fibers. Secretion of norepinephrine by sympathetic nerve fibers is increased under stressful conditions and this response can affect susceptibility to disease (McColl, 1983; Rideout *et al.*, 1985; Kinney *et al.*, 1999). Accordingly, alleviation of captivity-induced stress in zoo animals by providing a more relaxing environment and minimizing exposure to stressors can be effective for reducing bacterial infections (Carlstead and Shepherdson, 2000).



**Fig. 1: Swollen and discolored liver along with the enlarged gall bladder.**



**Fig. 2: Rod-shaped bacteria in the liver were tinted violet by Giemsa stain (1,000x magnification).**

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