

## A suspicious clinical case of goiter in aquarium-reared blood parrot cichlid (*Amphilophus citrinellus* × *Vieja melanurus*) with subsequent regression by Iodide administration

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A blood parrot (*Amphilophus citrinellus* × *Vieja melanurus*) cichlid showing a flared left operculum was sent to the Fish Disease Clinic. The fish showed intermittently irregular ventilation and reddish soft swellings located at the ventral part of the left branchial cavity for one month. Other abnormal symptoms were not observed, and the appetite was normal. Only a putative diagnosis was conducted based on the history taking and external symptoms because the owner did not want an invasive biopsy or other potentially stressful examination of the fish. Therefore, considering the information available and the treatability, goiter (thyroid hyperplasia) was suspected as the top differential diagnosis, and the empirical treatment of administering iodide (0.03~0.015ppm) in environmental water was conducted. The treatment was discontinued for six months because the swelling was noticeably reduced. Body color became pale, but other abnormal signs were not observed.

**Key words:** goiter, thyroid hyperplasia, blood parrot cichlid, iodide, nitrate

Blood parrot cichlid or blood parrot fish is a hybrid species of midas cichlid (*Amphilophus citrinellus*) and redhead cichlid (*Vieja melanurus*) produced in Taiwan. Their body color is commonly red to yellow but often shows other variations and patterns by injection of dyes. They are a popular aquarium fish species, particularly in China, due to their unique appearance and bright red color (Sui et al., 2016). Like other aquarium fish, they have similar infectious disease problems in aquarium tanks, and noninfectious disease problems are often observed due to their genetic deformity.

A blood parrot cichlid showing a flared left operculum was transferred to the Fish Disease Clinic in

March 2023. The fish was maintained in a 40.5-liter aquarium tank with no tank mates. Gravel was not used, and the water temperature was approximately 25°C. The owner described that the fish showed intermittently irregular ventilation for one month but had a normal appetite. A sponge filter was set, approximately 30 % of the water changed occasionally, and commercially available pet food was administered daily. During the physical examination, we found a large red-tinged soft swelling in the ventral part of the left branchial arches (Fig. 1). Diagnostic options for this fish included routine biopsy, imaging, and microbial culture after aspiration. However, invasive tissue biopsy for further process was not possible because the owner firmly declined any potentially harmful diagnostic process to the fish and elected to attempt empirical treatment. In the first place, we se-

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Fig. 1. Blood parrot cichlid with gross branchial lesions. Note the left branchial reddish swelling (arrow) before starting treatment.

lected antibiotic treatment (Oxytetracycline hydrochloride and Neomycin sulfate mixture, 1 g/10 liter as a commercial product, one hour every day). But, there was no visible improvement after two weeks of treatment. Cutaneous smear preparation of the swelling revealed no parasites or bacteria.

Based on the physical examination, neoplasia, mycobacteriosis, and goiter (thyroid hyperplasia) were the suspected differential diagnoses. Considering clinical observation (e.g., the appearance and location of the swelling) and accessibility of treatment, we suspected goiter as the top differential diagnosis and started iodide treatment; commercially available iodide solutions (iodine tincture) were diluted to the final concentration of 0.03 ppm in the treatment tank and the fish was transferred. The water temperature was maintained at 25°C during the treatment, and the food was administered as usual. 100% of the water was changed for one week. Then, 50% was changed every other day. The concentration of iodine was constantly maintained. After 14 days, we temporarily discontinued treatment and observed if there were any improvements in the swelling or clinical symptoms; the size of the swelling was noticeably reduced (Fig. 2). During the treatment, the body color became slightly pale, but no other abnormal signs were observed, and the ventilation became regular. The treatment was continued for an additional 14 days with the reduced iodide concentration of 0.015 ppm, and after that, the fish was brought back to the owner's fish tank, but the treatment was continued at home for six months. A recent physical examination (May

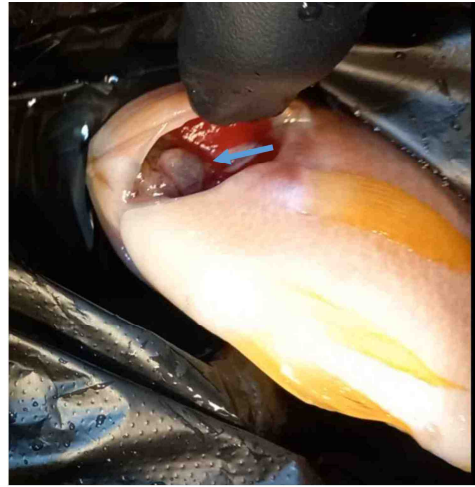


Fig. 2. The same fish after 14 days of treatment. Note the swelling noticeably reduced (arrow)

2024, approximately one year after discharge) revealed that the swelling had almost disappeared (Fig. 3). The body color was still pale, but there was no recurrence of any abnormal clinical signs. We recommended conducting partial water changes regularly and administering color-enhancing food.

Goiter or thyroid hyperplasia is a non-neoplastic and non-inflammatory thyroid gland enlargement found in all domestic mammals. Iodide insufficiency

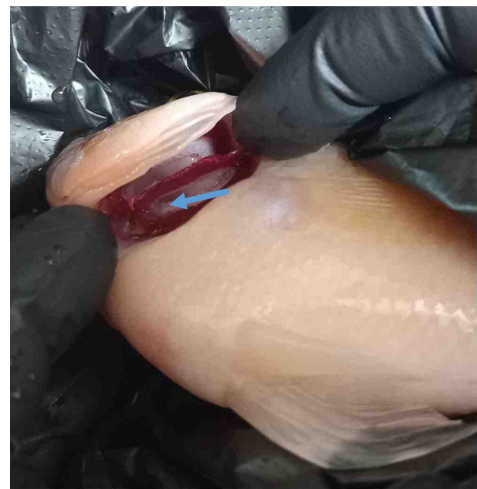


Fig. 3. The same fish after 6 months of treatment. The swelling is almost disappeared (arrow)

is the most common cause of goiter and consequently induces compensated thyroid gland hyperplasia for the reduced availability of iodide. Supplemental iodide in feeds is sufficient to resolve or prevent the development of symptoms associated with goiter (Elwood, 1985; Galgano et al., 2014).

Fish are also susceptible to goiter, and several fish species in freshwater, seawater, or brackish water in captive and natural environments are known to be involved in goiter (Crow et al., 2001; Shin et al., 2010; Morris et al., 2011; Simeone et al., 2015; Jalenques et al., 2020; Chan et al., 2024). The most common cause of goiter in fish is iodide deficiency, as in mammals; in the case of salmonid fish, thyroid hyperplasia was experimentally induced by nutritional iodine deficiency in food (Lall and Kaushik, 2021). However, little is known about the nutritional iodine requirement in fish. Fish species, growth, sex, age, physiological status, environmental stress, disease, and iodide content in water likely influence it (Lall and Kaushik, 2021). Clinical symptoms include dysphagia and anorexia, depending on the size of the swelling. This condition, if left untreated, can result in difficulty swallowing, causing decreased food intake, starvation, and eventually death. (Hadfield, 2021)

The iodide uptake in teleost originates from food and environmental water. Therefore, the most common treatment or prevention of goiter is oral supplementation with iodide. Alternatively, water supplementation with iodide may be effective as well. In general, commercially available pet fish food is nutritionally well-balanced, and there is no need to supply additional iodide in their meal. However, if the diet is deficient in iodide or the goitrogenic substances exist in the diet, oral supplementation of iodide will be necessary (Simeone et al., 2015; Jalenques et al., 2020; Chan et al., 2024).

Nitrate ( $\text{NO}_3$ ) in environmental water is known to be goitrogenic; nitrate is one of the sodium/iodide symporter (NIS) inhibitors blocking iodide uptake into the thyroid, thus affecting thyroid function (Mervish

et al., 2016). The high environmental nitrate ( $\text{NO}_3$ ) inhibits the ability of the thyroid gland to utilize available iodide, resulting in thyroid gland overstimulation by thyroid stimulating hormone and ultimately leading to the development of goiter. This phenomenon is particularly well-known in captive elasmobranchs (Morris et al., 2011; 2012).

In this clinical case, the owner described that the water change was not conducted regularly, so the nitrate level in the owner's fish tank was probably not in a normal range. Nitrates might impair the ability of iodide uptake from environmental water and consequently induce goiter. Swelling as the result of goiter can become expansive and may result in death if left untreated. We did not conduct histopathological analysis for confirmatory diagnosis because the owner did not permit invasive biopsy and decided to conduct empirical treatment against the possible cause of the swellings. Therefore, the etiology of goiter in this clinical case needs to be clarified. Supplementation of iodide in food or environmental water is known to be effective for prophylaxis or treatment of goiter in pet fish (Hadfield, 2021). The fish in this clinical case responded particularly well to the treatment, probably because the abnormal symptom was recognized early and immediate treatment was possible.

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