NOTE

Unilateral testicular hypoplasia in flower horn fish (hybrid cichlid)

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Abstract

Unilateral testicular hypoplasia in a male flower horn fish (hybrid cichlid) is described. Histopathologically, in the affected testis, seminiferous tubules had reduced luminal diameters with absence of spermatogenic cell maturation stages. No evidence of fibrotic seminiferous tubules, interstitial fibrosis and inflammatory response in the interstitium were seen.

The flower horn fish belongs to the Cichlidae family. It is believed that this fish emerged through selective cross-breeding of the three-spot cichlid Cichlasoma trimaculatum, the Guayas cichlid Cichlasoma festae and the jingang blood parrot, hybrid cichlid, in 1996 (Lin et al., 2008; Rahmati-holasoo et al., 2010, 2014a,b). This fish is becoming increasingly popular as a pet, especially in South-East Asia and Iran (Lin et al., 2008; Rahmati-holasoo et al., 2010, 2014a).

Abnormalities observed in fish testes include fusions to the trunk musculature, asymmetries, compartmentations, constrictions, atrophy/aplasia and intersex (Bernet et al., 2004). Several cases of fish populations with altered gonadal morphology have been recorded (Ruby and Cairns, 1983; Hunter and Macewicz, 1985; Demska-Zakes and Mamacarz, 1996; Wiklund et al., 1996; Fitzsimons and Cairns, 2000; Kinnison et al., 2000; Körner et al., 2005). In a study, whitefish Coregonus lavaretus from Lake Thun exhibited a high frequency of macroscopic and microscopic deviations of gonadal morphology (Bernet et al., 2004). Additionally, an extensive surveillance of whitefish populations in Lake Thun over several years showed different types of gonadal deviations such as compartmentation (where the gonads are divided into several separated lobes connected with each other by the sperm duct), gonadal fusions to the peritoneal wall, intersex and aplasia (Bittner et al., 2009).

Furthermore, in Lake Thun, Switzerland, a significant number of whitefish Coregonus lavaretus were found to exhibit abnormal gonadal morphology but atrophy/aplasia and compartmentations were rarely observed (0.9%) (Bernet et al., 2009). In another study, among 66 sexually mature male whitefish Coregonus fatii, no case of atrophy/aplasia was observed (Urbach et al., 2008).

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The internal examination of the visceral cavity of a 2-year-old male flower horn fish (hybrid cichlid) revealed abnormal gonadal structure. The significant change was observed in the right gonad. The right gonad appeared considerably smaller than the left one (Figure 1). The tissue samples were fixed in 10% neutral buffered formalin. The samples were processed for histological evaluation, embedded in paraffin, sectioned (4-6 μm) and stained with hematoxylin-eosin (H&E) and Masson’s trichrome. Sections were examined by light microscopy and photographs were taken.

No parasites were observed in the internal organs. Aerobic and anaerobic bacterial cultures from multiple internal organs resulted in no growth. Based on the findings of preliminary study, we determined that the abnormal gonad that showed a loose structure was testis tissue. Histopathologically, in the affected testis, seminiferous tubules had reduced luminal diameters with absence of spermatogenic cell maturation stages. There was no evidence of fibrotic seminiferous tubules, interstitial fibrosis or inflammatory response in the interstitium (Figure 2). Histologically the left gonad was normal.

The reasons for deviations in gonad are not clear yet, but several factors may individually or jointly affect gonadal morphology and development in fish. The frequency of abnormal gonads is influenced by factors such as sex, age, and spawning site; and also in whitefish of Lake Thun, by the different ecomorphs living sympatrically (Bernet et al., 2004; Bittner et al., 2009). Among the known environmental factors, temperature, parasites, and chemical substances are often cited as primary determinants (Blazer, 2002). Finally, hatchery management might add to the aforementioned exogenous factors. In particular, fertilisation practices, such as single male or sequential fertilisations (Wedekind, 2002; Wedekind and Müller, 2004; Wedekind et al., 2007), may decrease the overall genetic quality of individual fish, which in turn may affect gonadal morphology.

It is difficult to distinguish hypoplasia from testicular atrophy by using morphologic features (Foster, 2012). Bilateral testicular hypoplasia is a congenital condition that is hereditary and irreversible, while bilateral testicular atrophy is mostly acquired due to chronic pathologic changes affecting the testes such as degeneration and inflammation (Igbokwe et al., 2009, 2014; Mshelbwala and Igbokwe, 2010; Foster, 2012), also unilateral hypoplasia is more common than bilateral hypoplasia in veterinary literature (Foster, 2012). In our study the loose structure of the testis was unilateral. Unlike our study, atrophic testes have degenerate and fibrotic seminiferous tubules that are mostly accompanied by interstitial fibrosis and an inflammatory response in the interstitium (Foster, 2012). Moreover a wavy basement membrane was found in testicular atrophy, because affected tubules at some stages had reached full size and then subsequently collapsed (Foster, 2012).

On the basis of our histopathological findings, this case was diagnosed as a unilateral testicular hypoplasia and differentiated from testicular atrophy. Abnormally small hypoplastic testes, associated with impaired reproductive capacity, occur as a result of the failure of the testes to develop to normal size in a mature animal and may be caused by poor general nutrition, zinc deficiency, endocrine and cytogenetic abnormalities (Foster, 2012). The pathogenic
Figure 1. Macroscopic aspect of unilateral testicular hypoplasia in flower horn fish. The right testis (arrowheads) is smaller than the left testis (arrows).

Figure 2. The number and length of seminiferous tubules is reduced (arrows) (H&E).
basis for unilateral testicular hypoplasia in fish is unclear. To our knowledge, this is the first published account of a histological description of testicular hypoplasia in fish. On the basis of the macroscopic and microscopic characteristics, the cause of this testicular hypoplasia remains unknown.

References


