Concurrence of a fibroma and myxoma in an oranda goldfish (*Carassius auratus*)

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Abstract
Concurrence of fibroma and myxoma in an oranda goldfish (*Carassius auratus*) is described. The fish had two lesions on the dorsal region of the head and the base of the dorsal fin. Histologically, in the lesion on the head the presence of stellate and reticular cells lying in a mucoid matrix was diagnosed as a myxoma. The lesion on the base of dorsal fin was composed of mature fibrocytes producing abundant collagen in interwoven fascicles and was diagnosed as a fibroma. This is the first report of concurrence of fibroma and myxoma in a fish.

Introduction
Fibromas are benign neoplasms of fibrocytes with abundant collagenous stroma. Myxomas are tumours of fibroblast origin distinguished by their abundant myxoid matrix rich in mucopolysaccharides (Goldschmidt and Hendrick, 2002). Among domestic animals, fibromas have been frequently described in dogs. However, they are uncommon neoplasms in large animals (Goldschmidt and Hendrick, 2002). Fibromas in white-tailed and mule deer (Sundberg et al., 1985), human (Kamino et al., 1989), cow (Yeruham and Perl, 2001), horse (Scott and Miller, 2011) and dromedary camel (Al-Sobayil and El-Amir, 2013) have also been described. Myxomas are uncommon neoplasms in domestic animals, especially in dogs and cats (Goldschmidt and Hendrick, 2002). These tumors have been reported in the maxillary sinuses (House et al., 1976) and skin of horse (Zabady et al., 2012), the heart of human (Totsugawa et al., 2009). Fibromas have been described in electric catfish (*Malapterurus electricus*) (Stolk, 1957), southern flounder (*Paralichthys lethostigma*) and the hardhead sea catfish (*Arius felis*) (Overstreet and Edwards, 1976), flathead grey mullet (*Mugil cephalus*) (Lopez and Raibaut, 1981), redband parrotfish (*Sparisoma aurofrenatum*) (Grizzle, 1983), common carp (*Cyprinus carpio*) (Manier et al., 1984) and goldfish (*Carassius auratus*) (Constantino et al., 1999).

Myxomas have been reported in ayu sweetfish (*Plecoglossus altivelis altivelis*) (Honma, 1965), yellowtail amberjack (*Seriola lalandi*) (Keller et al., 2011), European eel (*Anguilla anguilla*) (Gjurčević et al., 2014) and blackfin sea catfish (*Arius jella*) (Singaravel et al., 2016).

To the authors’ knowledge there is no description of concurrence of fibroma and myxoma in a fish in the scientific literature. This is the first report of concurrence of fibroma and myxoma in a fish.

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Materials and methods

In June 2015, an oranda goldfish (Carassius auratus) with two distinctive lesions on the dorsal region of the head and base of the dorsal fin (Figure 1A) was referred to the Ornamental Fish Clinic, Faculty of Veterinary Medicine, University of Tehran. Swimming behavior and appetite of the fish were normal. Wet smears of skin, gills and faeces were prepared and observed by light microscopy (E600; Nikon). On gross examination, the fish measured 20 cm total length. Water parameters were checked at the referral time. Based on owner information, the fish had been kept alone in an aquarium for 4 years and the lesions had first been observed 4 months prior to submission and showed progressive growth. The fish was anaesthetized in 100 ppm PI222 (Pars Imen Daru; Iran). The lesions and a small amount normal surrounding skin were removed surgically for further diagnostic histology. The lesion located on the head region, was raised, white to yellow and approximately 7×4×3 mm. The cut surface was soft and gelatinous in consistency. The second lesion (on the base of the dorsal fin) was raised, white and approximately 6×5×2 mm. The cut surface was firm and homogeneous. Following excision wound repair was monitored for 9 days in clinic. Postoperatively, IM oxytetracycline (25 mg/kg) was provided and then 10 mg/L oxytetracycline was added to the tank water and retreated on day 3 after 50% water change. After that 50% of tank water was changed on day 6 and 9. Tissue samples of the masses were fixed in 10% neutral buffered formalin and routinely processed, dehydrated and embedded in paraffin wax with paraffin tissue processor (DS 2080/H; Did Sabz Co.) and paraffin dispenser (DS 4LM; Did Sabz Co.), sectioned at 5 µm (Rotary Microtome RM2145; Leica), stained with haematoxylin and eosin (H & E). The sections were also stained with Masson’s trichrome, Alcian blue (pH 2.5), Periodic Acid-Schiff reaction (PAS) and immunohistochemical staining for Desmin. Sections were examined using a light microscope (E600; Nikon) and representative images taken.

Results

No parasite was observed in wet smears of skin, gills and faeces. Water parameters were within normal range (Temperature 26°C, pH 7 and O₂ 7.5 mg/L). Histologically, the structure of the gelatinous mass on the head was composed of stellate-to-reticular cells distributed in a mucinous stroma containing few tiny blood vessels (Figure 1b and c). The myxoid cells were scattered, appearing singly or in small clusters. There was absence of haemorrhage and necrosis and no evidence of mitotic figures. Myxoid cells displayed pale nuclei round to oval in shape. In the special staining, the myxomatous stroma revealed positive reaction for alcian blue (Figure 2B) and confirmed that the matrix had characteristics of acidic glycosaminoglycans. The stroma stained pale positive with PAS, indicating the presence of glycosaminoglycan in the myxoid mass (Figure 2C). There was no evidence of positive reaction for desmin. The presence of stellate and reticular, PAS-positive cells lying in an alcianophilic mucoid matrix supported a diagnosis of myxoma.

By contrast, the lesion on the base of the dorsal fin exhibited a different structure. It was composed of mature fibrocytes producing abundant collagen. The collagenous fibers were repeti-
Figure 1. (a) Oranda goldfish (*Carassius auratus*) with myxoma (arrowhead) and fibroma (arrow). (b-c) Histological sections of the myxoma showing the presence of few stellate and reticular cells lying in a mucoid matrix. (d) Histological section of the fibroma (H&E).

Figure 2. (a) Higher magnification of the fibroma. Note the fibrocytes and the dense and interwoven pattern of repetitive collagen in fibroma (H&E). (b) Histological section of the myxoma with Alcian blue stain (pH 2.5) revealing that the matrix is alcianophilic (arrowheads). (c) Positive staining for PAS in the mucinous stroma of myxoma. (d) Positive staining for Masson's trichrome in the fibroma.
tive and were usually arranged in interwoven fascicles, more rarely in whorls (Figure 1D). The neoplastic fibrocytes were spindle-shaped, with oval normochromatic nuclei and an indistinct cytoplasm that were blended into the extracellular collagenous stroma (Figure 2A). In some areas, fibroblasts formed multidirectional bundles, separated by a small amount of collagen. There were few mitotic figures. The collagenous fibers of fibroma had positive staining reaction for the Masson’s trichrome and were stained blue (Figure 2D). Based on histological findings, typical cellular morphology and the focal non-invasive behavior of the fibroblasts, this was diagnosed as a fibroma. This is the first report of concurrence of fibroma and myxoma in a fish. The postoperative recovery period was uneventful and based on the owner information; the tumours did not recur during the following 6 months.

Discussion
Spindle cell tumours are common spontaneous cutaneous neoplasms of fish (Groff, 2004). The mass that was in the base of the dorsal fin was classified as fibroma, although it is not possible to definitively exclude other types of spindle cell tumours, such as neurofibroma or chromatophoroma, without ultrastructural examination (Dennis and Diggles, 2015). However, morphological features, the predominance of collagen and non-pigmented elongated fibrocytic type cells with no invasion into underlying skeletal muscle and between and around bones is diagnosed as a fibroma (Roberts, 2001). These characters were similar to the fibroma in this case.

Myxomas have been described in fish (Honma, 1965; Keller et al., 2011; Gjurčević et al., 2014; Singaravel et al., 2016), but their occurrence is rare compared to fibromas (Manera and Biavati, 1995). Microscopically, myxomas have low cellularity and rare mitoses, but increases in cellular density and mitoses warrant the diagnosis of myxosarcoma (Goldschmidt and Hendrick, 2002). No hypercellularity and mitoses were identified in the present case. Myxoma can be diagnosed only on the basis of tumour histopathology, because the loose tissue does not give clear and reliable IHC results (Gjurčević et al., 2014).

Fibromas and myxomas generally are considered to be spontaneous (Groff, 2004; Keller et al., 2011) and surgical excision is the treatment of choice for them (Goldschmidt and Hendrick, 2002) which was also performed successfully in the present case.

Fibromas and myxomas are usually seen in adult or aged dogs and cats (Goldschmidt and Hendrick, 2002), horse (Zabady et al., 2012; Scott and Miller, 2011) and human (Totsugawa et al., 2008) similar to this case. Predisposing factors such as carcinogenic compounds, viruses, irritants, oncogenes and parasites have all been reported in teleosts and should be considered potential sources for tumour induction in the tropical fish (Stoskopf, 1993). But in this study, no predisposing factors were observed and cause of these tumours remains unknown.

References

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