NOTE

Pulse granulomas detected in peritoneum of a wild rainbow trout, *Oncorhynchus mykiss*, with acanthocephalan infections

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Abstract
Pulse granulomas (PG) are reactions to particles of food that are characterized by clusters of small to medium-sized hyaline rings. This report describes a case of multiple pulse granulomas, found adhering to the visceral and parietal peritoneum of the abdominal wall of a wild rainbow trout. This was associated with fistulae, involving the gastrointestinal tract, resulting from deep penetration of acanthocephalans into the intestinal wall.

Foreign materials may develop inflammatory reactions with multinucleated giant cells. Pulse granulomas are peculiar reactions to particles of food that are characterized by giant cells and clusters of small to medium-sized hyaline rings. Pulse granulomas are uncommon in mammals and humans and may be located in the lungs and in the alimentary canal. Localization in the lung is related to aspiration of foreign material, and in the alimentary canal to perforation and fistulae involving the gastrointestinal tract (El-Labban and Kramer, 1981).

In fish granulomatous inflammation with giant cells are also found, particularly in micobacteruim, fungal, parasitic infections and foreign body- type reactions (Ferguson, 1989) but reports of pulse granulomas in fish are uncommon (Ziegenfuss and Wolke, 1991; Reimschuessel, 2008). In the presence of a foreign antigen, this cell type becomes "activated" and avidly phagocytic (Adams, 1976; Johnson, 1988). If a highly persistent antigen is present, it may differentiate further into a multinucleated giant cells (Sutton and Weiss, 1966).

This report describes a case of multiple pulse granulomas found adhering to the visceral parietal peritoneum of the abdominal wall peritoneum of a rainbow trout, *Oncorhynchus mykiss* (Walbaum, 1792). The report demonstrates that pulse granulomas can occur in fish, in the alimentary canal, and can be associated with fistulae resulting from deep penetration of acanthocephalans into the intestinal wall. The pulse granulomas were always associated with food particles. Acanthocephalans attach and penetrate through the host´s intestinal wall by

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means of their protrusive proboscis which is armed with hooks (Taraschewski, 2000).

The described pathological changes were observed in a rainbow trout from the Lagoon La Florida, San Luis, Argentina. The fish's weight was 670 g and had a total length of 480 mm.

During necropsy multiple nodules of a firm greyish white tissue on the serosal side of the intestinal wall were observed with corresponding acanthocephalans attached to the mucosal side of the intestine creating deep lesions and perforations (Figure 1).

Following routine diagnostic procedures, tissues were formalin fixed in 10% buffered formalin for subsequent histopathological evaluation. The samples were dehydrated in graded series of ethanol, embedded in paraplast, sectioned (5 μm) and the slides were stained with H&E and PAS.

Microscopy showed several acanthocephalans. *Acanthocephalus* sp. deeply penetrating into the intestinal wall, with inflammatory tissue dominated by monocytes, macrophages and lymphocytes around the parasite (Figure 2). Pulse granulomas were observed in visceral and parietal peritoneum, containing small to medium-sized hyaline rings, multinucleated foreign body-type giant cells with cytoplasmic vegetable matter (Figure 3 and 4).

Pulse granulomas are uncommon entities characterized by eosinophilic hyaline rings with acute and chronic inflammation and multinucleated giant cells. The rings vary in size

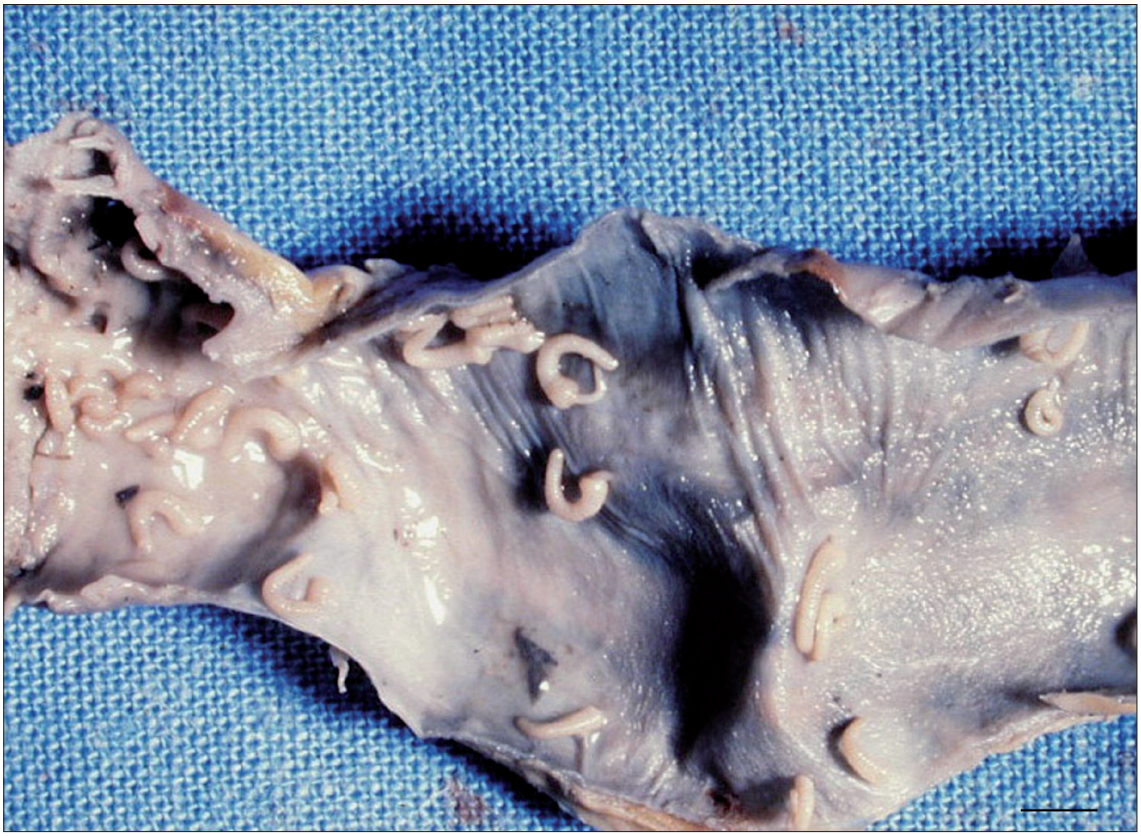

Figure 1. *Acanthocephalus* sp. attached to the intestinal wall, Bar = 0,5 cm.

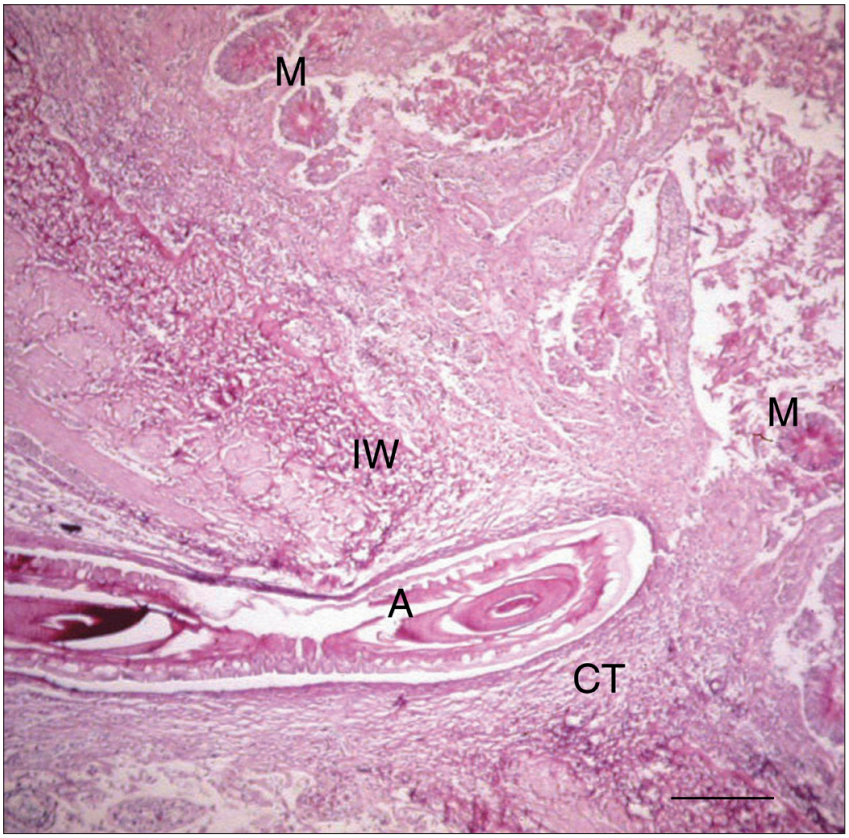

Figure 2. Photomicrograph showing a specimen of *Acanthocephalus* sp. (A). Note that the worm has perforated the intestinal wall (IW). Inflamory and connective tissue (CT). Note necrosis the mucosal and lamina propia(M). PAS-staining, Bar = 200 μm.

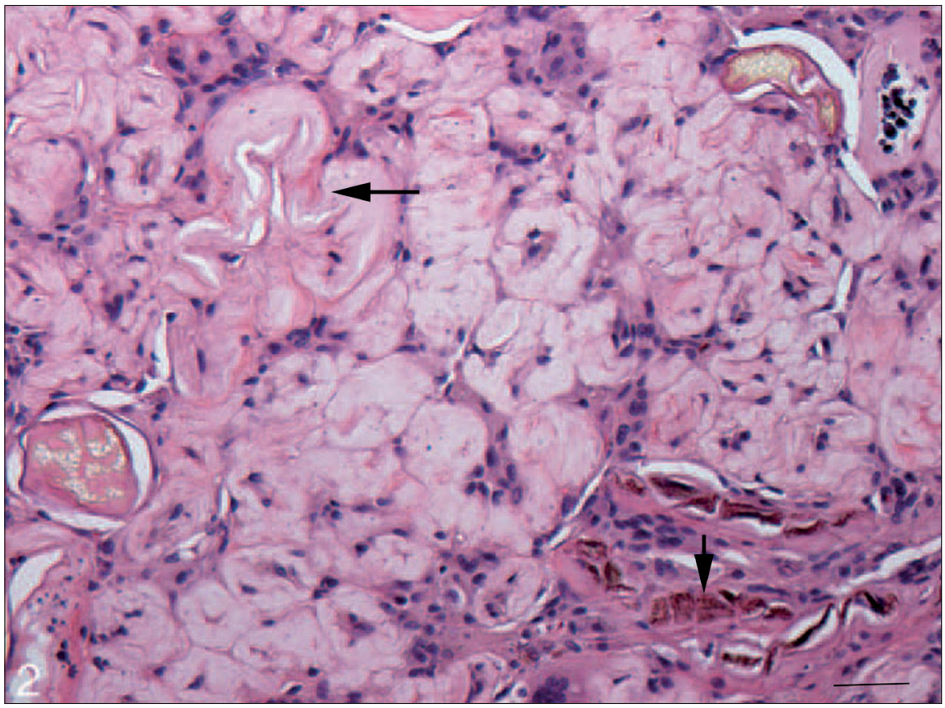

Figure 3. Photomicrograph showing hyaline rings (long arrows) and vegetable matter (short arrows). H&E-staining, Bar = 100 μm.

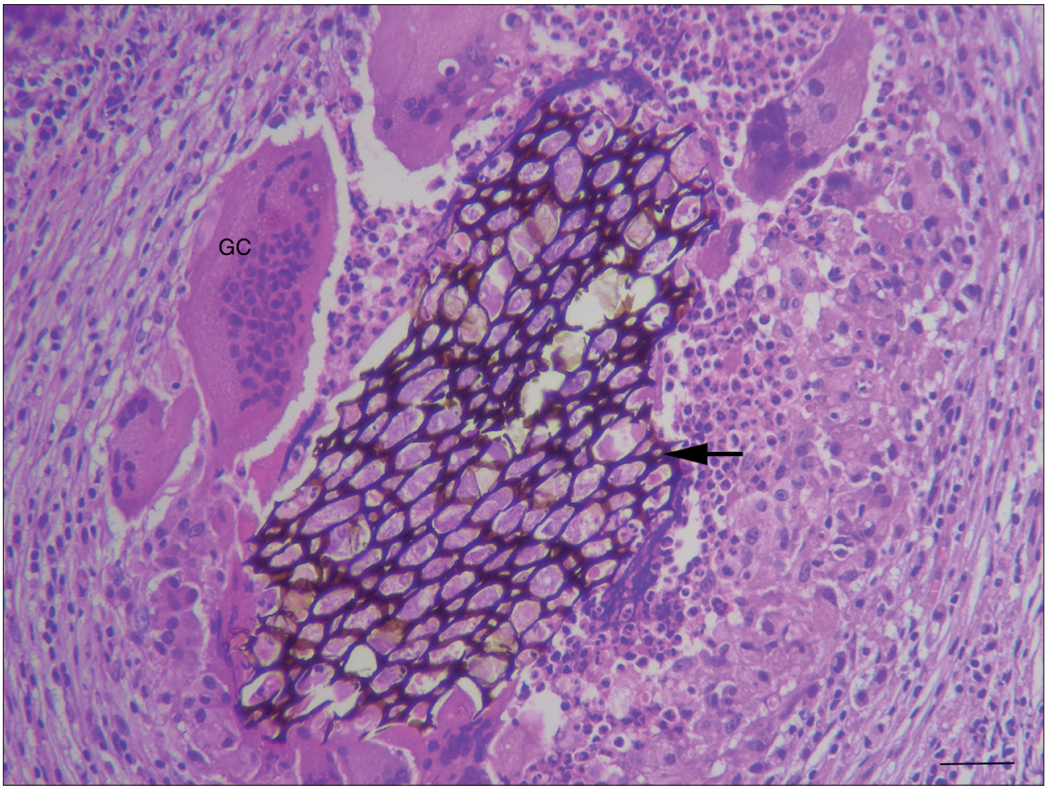

Figure 4. Photomicrograph showing multinucleated foreign body-type giant cells (GC) partially surrounding vegetable matter (arrows) and inflammatory tissue. H&E-staining, Bar = 200 µm.

and shape, and are usually associated with vegetable matter. Therefore, pulse granulomas are widely regarded as unusual reactions to vegetable matter. Hyaline rings were initially described by Knoblich (1969), who noted these lesions in human lungs and reproduced similar lesions in various nonprimate animal lungs by injecting broth of lentils, the seeds of leguminous plants.

The precise composition of the hyaline rings is controversial. In our observations, vegetable matter was exclusively outside the hyaline rings, suggesting that the hyaline rings represented structures other than vegetable matter. Similar findings have been reported by others (El-Labban and Kramer, 1981). The hyaline rings were previously thought by some authors to represent vasculitis; however, there remains little evidence to support this theory. Hyaline rings have shown ultrastructural features of degenerated collagen and cellulose (Harrison and Martin, 1986).

The term "pulse granuloma" was later applied to similar lesions that occupied the orofacial region. Most cases demonstrated vegetable matter, bolstering the prevailing notion that hyaline rings represent unique reactions to vegetable matter (Harrison and Martin, 1986; Pereira et al., 2001; Zhai and Maluf, 2004). This article reports that pulse granulomas can occur in fish, in association with passage of gastrointestinal contents (with food particles) through perforation of the intestinal wall by acanthocephalans.

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