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DISEASE IN WILDLIFE OR EXOTIC SPECIES

Renal Lesions in Cetaceans from Brazil

O. Gonzales-Viera[*,†], V. Ruoppolo[†,‡], J. Marigo[†,§], V. L. Carvalho[‖], K. R. Groch[†], C. P. Bertozzi[§], C. Takakura[¶], G. Namiyama[#], R. E. T. Vanstreels[†] and J. L. Catão-Dias[†]

** Department of Pathology, Microbiology and Immunology, University of California, Davis, CA, USA, † Laboratório de Patologia Comparada de Animais Selvagens (LAPCOM), Departamento de Patologia, Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, São Paulo, Brazil, ‡ International Fund for Animal Welfare, Yarmouth Port, MA, USA, § Projeto Biopesca, Praia Grande, São Paulo, ‖ Associação de Pesquisa e Preservação de Ecossistemas Aquáticos, Ceará, ¶ Laboratório da Disciplina de Patologia de Doenças Transmissíveis, Faculdade de Medicina, Universidade de São Paulo and # Núcleo de Microscopia Eletrônica, Centro de Procedimentos Interdisciplinares, Instituto Adolfo Lutz, São Paulo, Brazil*

Summary

This study reports the occurrence of renal lesions in cetaceans from the coast of Brazil subjected to necropsy examination between 1996 and 2011. The animals ($n = 192$) were by-caught in fishing nets, were found dead on beaches or died despite attempted rehabilitation. Kidney samples were evaluated grossly and microscopically and, depending on the histopathological findings, immunohistochemical and ultrastructural analyses were conducted. Due to autolysis, a diagnosis was reached in only 128 animals, of which 82 (64.1%) had kidney lesions. Cystic renal disease was the most common lesion observed in 34 cases (26.6%) and these were classified as simple cysts in eight cases (6.3%), polycystic kidney disease in one rough-toothed dolphin (*Steno bredanensis*), secondary glomerulocystic disease in 16 cases (12.5%) and primary glomerulocystic disease in nine cases (7%). Other lesions included membranous glomerulonephritis (28 cases; 21.9%), membranoproliferative glomerulonephritis (20 cases; 15.6%), lymphoplasmacytic interstitial nephritis (21 cases; 16.4%), lipidosis (19 cases; 14.8%), glomerulosclerosis (8 cases; 6.3%) and pyogranulomatous nephritis(five cases; 3.9%); two of the later were associated with the migration of nematode larvae. Additionally, tubular adenoma was identified in a Franciscana (*Pontoporia blainvillei*). The pathological implications of these lesions are discussed according the cause of death, age or sex of the animals. Furthermore, the lesions were compared with those of other marine and terrestrial mammals, including man.

Keywords: cetaceans; cystic renal disease; kidney; pathology

Introduction

Specialized kidneys in cetaceans are an important adaptation to their marine environment (Hedges *et al.*, 1979; Ortiz, 2001). Because of their reniculate morphology and increased medullary thickness, the kidneys play a key role in salt excretion and water conservation (Hedges *et al.*, 1979). In cetaceans and other marine mammals, pathological changes have been described in the lung (Gonzales-Viera *et al.*, 2011; Venn-Watson *et al.*, 2012), liver (Jaber *et al.*, 2004), thyroid gland (Cowan and Tajima, 2006) and pituitary gland (Cowan *et al.*, 2008), but there has been no specific study of renal pathology in these species.

Renal infections are uncommon in cetaceans, and when occur they tend to be related to systemic processes (Sweeney and Ridgway, 1975). *Pasteurella* spp. is a significant bacterial pathogen that can infect the kidneys of cetaceans, causing nephritis as a consequence of acute septicaemia (Dunn *et al.*, 2001).

Correspondence to: O. Gonzales-Viera (e-mail: gonzalesviera@ucdavis.edu).

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Similarly, there are reports of renal mycosis in cetaceans secondary to systemic dissemination of *Candida albicans* (Reidarson *et al.*, 2001), zygomycetes (Robeck and Dalton, 2002) or *Rhizomucor* spp. (Wünschmann et al., 1999). Nematodes such as *Crassicauda* spp. are observed occasionally in kidneys and other tissues, with the tail of adult stages reaching into the calyx to eliminate eggs through the urine (Dailey, 2001). Finally, interstitial nephritis associated with a novel alphaherpesvirus was diagnosed in a Blainvillei's beaked whale (*Mesoplodon densirostris*) (Arbelo *et al.*, 2012) and in a striped dolphin (*Stenella coeruleoalba*) with systemic herpesvirus and morbillivirus co-infection (Soto *et al.*, 2012).

Idiopathic nephritis has been described in a number of cetaceans (Howard, 1983; Di Guardo *et al.*, 1995; Cornaglia *et al.*, 2000); however, this change may have had multiple possible causes that were not clarified (Howard, 1983). Even though cetaceans are known to accumulate a number of chemical carcinogens in their tissues (Martineau *et al.*, 2002), reports of primary renal tumours are less common than those arising in other tissues (Newman and Smith, 2006). Additionally, cystic kidneys of different sizes have been observed in dolphins and other marine mammals and these cysts were considered to be developmental (Howard, 1983).

The aim of the present study was to describe the gross, microscopical, immunohistochemical and ultrastructural features of renal lesions in cetaceans from Brazil.

Materials and Methods

Studied animals were found ashore or incidentally captured along the coast of seven Brazilian States between 1996 and 2011: Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Rio de Janeiro, Pernambuco and Ceará (Table 1). Necropsy examinations were undertaken by veterinarians or biologists and all tissue samples were deposited in the Marine Mammal Tissue Bank (BTMM) at the Laboratório de Patologia Comparada de Animais Selvagens (LAPCOM), Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, São Paulo, Brazil. Information about the gender, age and cause of mortality were provided by the staff who performed the examinations. The ages of the animals were estimated based on the total body length or by counting the number of growth layers in the dentine (Kasuya and Brownell, 1979).

Gross and Histological Examination

Gross findings, when present, were recorded on standard forms. Kidney samples were fixed in 10% neutral buffered formalin and processed routinely. Briefly, the tissues were dehydrated through graded alcohols, embedded in paraffin wax, sectioned (3 μm) and stained with haematoxylin and eosin (HE). When appropriate, serial sections were stained by Masson's trichrome, periodic acid–Schiff (PAS), Brown and Bren, Congo red and Ziehl Neelsen stains. The inflammatory, degenerative and cystic findings

Table 1
Information on the cetaceans investigated according their sex, age class and origin

Species	*Number of animals*	*Sex*			*Age class*				*Origin*			
		M	*F*	*NR*	*Adult*	*Juvenile*	*Calf*	*NR*	*By-catch*	*Stranded*	*Rehabilitation*	*NR*
Balaenoptera acutorostrata	2	1	1	–	–	1	–	1	–	1	–	1
Megaptera novaeangliae	2	2	–	–	1	–	1	–	–	2	–	–
Delphinus capensis	2	2	–	–	2	–	–	–	–	1	1	–
Globicephala macrorhynchus	3	3	–	–	–	2	1	–	–	3	–	–
Kogia breviceps	2	1	1	–	2	–	–	–	–	2	–	–
Kogia sima	2	2	–	–	1	–	1	–	–	2	–	–
Lagenodelphis hosei	2	–	2	–	1	1	–	–	–	2	–	–
Mesoplodon europaeus	1	–	1	–	1	–	–	–	–	–	1	–
Peponocephala electra	2	–	2	–	–	2	–	–	–	2	–	–
Physeter macrocephalus	2	–	2	–	–	–	2	–	–	2	–	–
Pontoporia blainvillei	125	71	53	1	36	74	7	8	91	9	22	3
Sotalia guianensis	22	14	8	–	8	5	6	3	6	7	9	–
Stenella clymene	3	1	2	–	3	–	–	–	–	3	–	–
Stenella coeruleoalba	2	–	2	–	2	–	–	–	–	2	–	–
Stenella frontalis	6	4	2	–	4	2	–	–	2	4	–	–
Stenella longirostris	4	3	1	–	1	2	1	–	–	4	–	–
Steno bredanensis	4	3	1	–	1	2	1	–	1	1	1	1
Tursiops truncatus	6	3	2	1	4	1	–	1	1	4	1	–
Total	**192**	**110**	**80**	**2**	**67**	**92**	**20**	**13**	**101**	**51**	**35**	**5**

M, male; F, female; NR, Not recorded.