

CASE REPORT

Zoo animals

Cholangiocellular adenoma in Franciscana dolphins (*Pontoporia blainvillei*)

Hassan Jerdy¹  | Vanessa Ribeiro² | Aline Souza³ | Rodrigo Valle⁴ | Priscilla Maracini² | Carolina Bertozzi⁴ | Rachel Ann Hauser-Davis⁵ | Eulógio Carvalho⁶

¹Laboratório de Microscopia, Federal University of the South and Southeast of Pará, Xinguara, Pará, Brazil

²Instituto Biopesca - IBP, São Paulo, São Paulo, Brazil

³Universidade Vila Velha, Vila Velha, Espírito Santo, Brazil

⁴Universidade Estadual Paulista Julio de Mesquita Filho - UNESP, São Vicente, São Paulo, Brazil

⁵Laboratório de Avaliação e Promoção da Saúde Ambiental, Oswaldo Cruz Institute, Oswaldo Cruz Foundation, Rio de Janeiro, Rio de Janeiro, Brazil

⁶Universidade Estadual do Norte Fluminense Darcy Ribeiro - UENF, Rio de Janeiro, Rio de Janeiro, Brazil

Correspondence

Hassan Jerdy, Laboratório de Microscopia, Federal University of the South and Southeast of Pará, Rua Alberto Santos Dumont, Xinguara, PA, Brazil. Email: hjerdy@hotmail.com

Abstract

Pontoporia blainvillei, commonly known as the Franciscana dolphin, inhabits the coastal waters of South America and is classified as vulnerable and as undergoing significant population declines. This species is generally found in turbid coastal waters, although it is also found in clear waters, as well as marine areas associated with islands and rocky shores. Tumours originating from cholangiocytes have been rarely described in cetaceans, with descriptions limited to cholangiocellular carcinomas. Cholangiocellular adenomas are characterised by the formation of bile ducts and are rarer than cholangiocellular carcinoma. This study described the first report of a tumour originating from cholangiocytes in *P. blainvillei*, raising concerns on this endangered cetacean's health status and conservation. The underlying causes of this tumour in Franciscana dolphins remain unknown, highlighting the need for further research.

KEYWORDS

cetaceans, cholangiocellular adenoma, neoplasia, *Pontoporia blainvillei*

BACKGROUND

Pontoporia blainvillei, known as the Franciscana dolphin, inhabits coastal areas between the state of Espírito Santo, Brazil (18°25'S) and the San Mathias Gulf, in the Rio Negro province, in Argentina (42°10'S).^{1,2} This species conservation status is defined as Vulnerable by the International Union for Conservation of Nature (IUCN) Red List,³ and it is regarded as the most endangered western South Atlantic cetacean.⁴

Several hepatic health issues have been reported for distinct cetacean species. For example, chronic hepatitis, cholangitis caused by parasites and hepatic lipidosis have been described in Cayman Island cetaceans,⁵ while malignant hepatic tumours have been described in *Zalophus californianus*, *Delphinapterus leucas*, *Mirounga angustirostris* and *Delphinus capensis*.^{6–9} Furthermore, high cancer rates have been observed in beluga whales (*Delphinapterus leucas*) living in areas polluted by metals and other contaminants.¹⁰ Cholangiomas, comprising uncommon benign hepatic tumours, generally displaying a solid and limited mass, however, have not yet been reported in cetaceans.

Material and methods

A total of 2723 cetacean carcasses belonging to 29 different species were necropsied during the execution of the Santos Basin Beach Monitoring Project (PMP-BS),¹ in Brazil, with histopathological analyses performed in carcasses at decomposition status Codes 2 and 3, according to Geraci and Lounsbury.¹¹

CASE PRESENTATION

A total of 415 Franciscana dolphins were necropsied during the execution of the Santos Basin Beach Monitoring Project from September 2015 to September 2021, with only one adult male, 8.2 years old, 119.1 cm in length and weighing 18.8 kg, at decomposition status code 3,¹² presenting a liver tumour. This specimen was found dead stranded in the beach in Praia Grande, coastal area of the São Paulo State, Southeast of Brazil, on 21 February 2018.

INVESTIGATIONS

Postmortem examinations

Macroscopically, the only altered liver displayed one encapsulated nodule, not adhered, round and whitish, about 0.5 cm in diameter (Figure 1a).

Histopathology assessments

Liver samples were collected during the postmortem examination and fixed in 10% buffered formalin for at least 48 hours. The samples were then cleaved and forwarded to a Leica ASP300S tissue processor (Leica microsystem CMS), subsequently undergoing dehydration, clarification, paraffin impregnation and posterior inclusion into paraffin blocks. Following paraffin inclusion, the samples were cut to 5 μ m thickness and haematoxylin–eosin stained. The microscopic analyses and microphotographs were performed under a Leica DM4B optical microscope (Leica microsystem CMS).

Microscopically, the tumour was peripherally delimited by a thin capsule formed by thin fibrous tissue, exhibiting moderate cellularity and expansive behaviour associated with mild compression on the surrounding liver parenchyma (Figure 1b). The tumour was organised into well-formed ducts supported by a thin fibrous tissue, with no hepatocytes detected between ducts. The tubular formations were lined with a single layer of well-differentiated epithelial cells (Figure 1c). Epithelial cells exhibited a moderate amount of eosinophilic cytoplasm without defined borders. The nucleus was noted as paracentral, basophilic, normally stained with euchromatic chromatin and presenting a small, oval nucleoli. Pleomorphism and anisocytosis were mild, and the mitotic index was 0 in the entire sample.

DIFFERENTIAL DIAGNOSIS

Cholangiocellular adenomas are formed by small-calibre cystic structures, lined with a single layer of well-differentiated biliary epithelium and moderate amounts of intervening stroma. Typically, no mitotic figures are detected, and nucleoli are small or inapparent. Hepatocytes are usually compressed at the margins, but not found between tubules. The key features that differentiate biliary adenomas from biliary carcinomas comprise lining epithelium differentiation degrees, the absence of mitoses and the lack of an invasive growth pattern in cholangiocellular adenomas. Cholangiocellular adenomas grow by expansion and may compress the surrounding parenchyma.¹² Herein, the calibre, number of epithelial cell layers, differentiation, amount of stroma and expansive growth associated with compression of hepatocytes at the tumour margins are compatible with cholangiocellular adenoma descriptions. Furthermore, the mitotic index in all tumours was 0, and the nucleoli were round and small.

The developmental nature of cystic liver disorders is more clearly appreciated when they are coincident with renal cysts. The cysts are separated by variable amounts of fibrous tissue.¹² Only the liver was altered in the *P. blainvillei* specimen, and the amount of fibrous tissue was scarce, not variable and did

LEARNING POINTS/TAKE-HOME MESSAGES

- This study reports a rare neoplasm in *Pontoporia blainvillei* for the first time.
- The detected lesion is similar to cholangiomas in other mammals.
- The findings contribute to *Pontoporia blainvillei* conservation and management.

not exhibit any neoplastic process, all of which are compatible with a cholangiocellular adenoma diagnostic.

Histologically, bile duct adenomas are made of a compact proliferation of small ducts with small or inapparent lumens lined by a cuboidal epithelium with a slightly basophilic cytoplasm and bland, regular nuclei. Mitoses, cytologic atypia and nuclear pleomorphism are absent. Ductular structures are surrounded by a fibrotic hyalinised stroma that can distort duct structures.¹² The description reported herein is equivalent to histomorphology and cytomorphology reports in humans.

Immunohistochemistry (IHC) staining for the tight junction protein claudin-7 protein has been reported to differentiate canine cholangiocellular carcinoma from hepatocellular carcinomas, as it is only expressed in biliary epithelium. In this sense, normal bile duct epithelium, cholangiocellular adenomas and carcinomas stain positive for claudin-7.¹² Immunohistochemistry marks cholangiocytes without any specificity, so IHC assessments do not increase accuracy of the differential diagnosis of cysts, biliary hyperplasia, adenomas or carcinomas.

Metastases to regional lymph node or distant tissues are obvious carcinoma evidence.¹² The tumour described in this cetacean, however, was well delimited with no evidence of metastases.

DISCUSSION

Cholangiocellular adenomas are quite rare.¹² Lesions interpreted as these tumours have been reported in dogs,¹³ cats,¹⁴ sheep¹⁵ and pigs,¹⁶ and individual reports of cholangiocellular adenomas are available for cows.¹⁷ The rarity of cholangiocellular adenomas¹² hampers the accurate definition of its incidence.¹⁴ To the best of our knowledge, this kind of neoplasia has never been reported in cetaceans, making this study the first in this regard.

Macroscopically, the intrahepatic lesion was a unique limited, whitish, round-shaped tumour, compatible with other descriptions reported for different species, such as dogs and cats.¹⁵ The epithelium coating the tubules was well-differentiated, performing peripheral compression, displaying small nucleoli, no mitosis and scarce pleomorphism, compatible with other descriptions previously reported for domestic species.¹² Biliary cholangiocellular adenomas have been described in old dogs and cats, and although they are not associated as cholangiocellular carcinoma precursors, this is a possibility.¹⁸⁻²⁰

Regarding liver tumours and carcinogenesis, benign proliferations may comprise a first stage of cancer development.^{19,20}

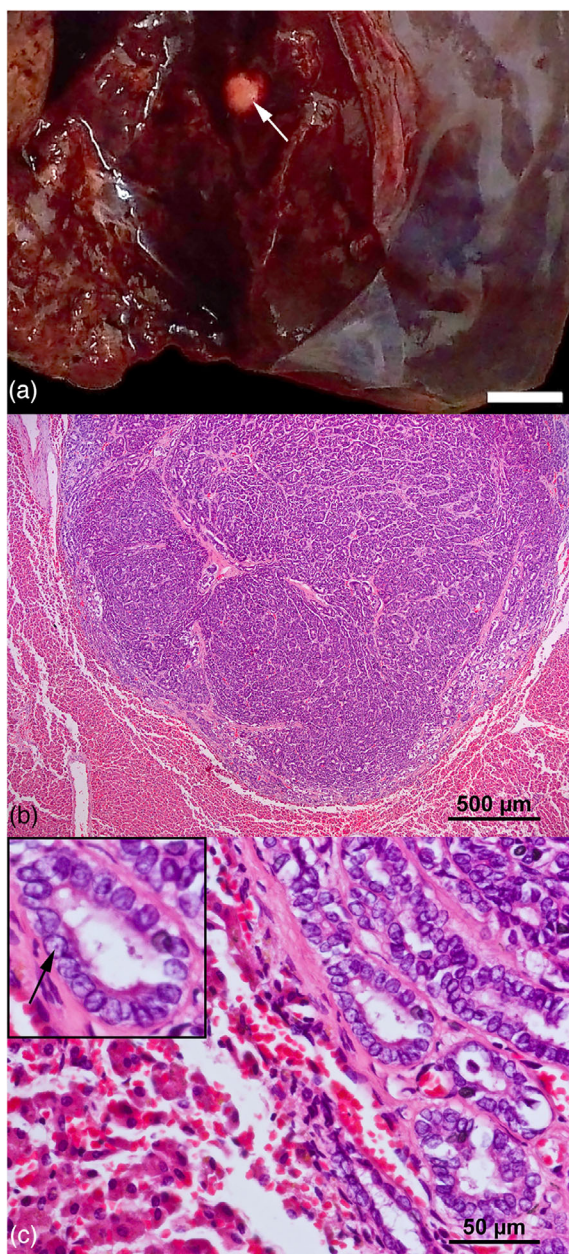


FIGURE 1 (a) Liver. Small whitish and well-delimited cholangiocellular adenoma (arrow). (b) Liver. Cholangiocellular adenoma presenting proliferated bile ducts and expansive behaviour. (c) Liver. Well-formed bile ducts, lined with a single layer of well-differentiated and homogeneous cells. Inset. Note regular bile duct lined by one layer of well-differentiated cells, moderate amount of cytoplasm and small round nucleoli (arrow).

The rarity of cholangiocellular adenomas,¹⁸ however, makes it almost impossible to establish this relation, even more so in dolphins.

In humans, colangiocellular carcinomas may arise from cholangiocellular adenomas.²¹ No malignancy aspects, such as the invasion of the basement membrane or tumour capsule, severe pleomorphism, mitosis or metastasis were, however, identified in the present study. This case paves the way for future cholangiocellular carcinoma reports in cetaceans. In humans, the lesion typically appears as a discrete white nodule, usually solitary and subcapsular in location, with a firm consistency.²¹ In *P. blainvillei*, the colour and consistency were identical to those reported in humans, also comprising a solitary lesion.

Contaminant exposure may result in severe hepatic alterations in exposed organisms, and changes in hepatocytes known to result in nodule formation are usually associated with chemical carcinogen exposures. For example, experimental exposures to different contaminants have been reported as inducing biliary neoplasia in several fish species,²²⁻²⁹ and chemical carcinogens such as nitrosamine can induce cholangiocellular adenomas in dogs and pigs.^{30,31} Other aetiological possibilities, however, also exist, such as exposure to viruses and mycotoxins.²⁰

A wide variety of persistent bioaccumulative chemical pollutants have been reported in Franciscana tissues in Brazilian waters,³²⁻³⁸ probably due to its endemic coastal water occurrence,² resulting in heightened exposure to anthropogenic pollutants, as most human activities take place in coastal areas worldwide. In fact, certain toxic compounds, that is, polychlorinated biphenyls, organochlorine pesticides such as dichlorodiphenyltrichloroethane, and its manufacturing byproducts Tris(4-chlorophenyl)methane and its metabolite, Tris(4-chlorophenyl)methanol in *P. blainvillei* from southeastern Brazil, the most developed area of the country are, in fact, comparable to other dolphin species from the North Atlantic.³³ These contaminants are a major health concern for *P. blainvillei* populations, as they exhibit high carcinogenic, neurotoxic, immunosuppressive and endocrine disruptive potential.³⁹⁻⁴³ Some contaminants of emerging concern, such as titanium, have also recently been detected in different *P. blainvillei* organs, with proven subcellular partitioning, indicating systemic contamination with unknown physiological effects.⁴⁴

As stated previously, cholangiocellular adenomas are benign tumour that may be precursors to cholangiocellular carcinomas.²⁰ If this hypothesis is correct, the fact that cholangiocellular adenomas are benign is most often an incidental finding that can be overlooked or not detected, due to tumour size, which may account for a lack of reports of this kind in cetaceans. If malignancy occurs in a still small cholangiocellular adenoma, the diagnosis will be defined as cholangiocellular carcinoma, making it difficult to detect cholangiocellular adenomas.

This is the first report of neoplasia in *P. blainvillei* and the first report of a cholangiocellular adenoma in cetaceans. Besides being the first description of this tumour in cetaceans, this study is a specific alert concerning marine chemical contamination due to human activities, which have increasingly become a serious issue worldwide. The biological behaviour and macroscopic and microscopic aspects of the detected lesion are very similar to cholangiomas described in other mammal species. Cholangiocellular adenoma should be considered a differential hepatic tumour diagnosis in *P. blainvillei*.

AUTHOR CONTRIBUTIONS

Manuscript drafting and revision: Hassan Jerdy, Vanessa Ribeiro, Rodrigo Valle, Priscilla Maracini, Aline Souza, Carolina Bertozzi, Rachel Ann Hauser-Davis and Eulógio Carvalho. Project conception and design, gross and microscopic descriptions: Hassan Jerdy. Data acquisition: Hassan Jerdy, Vanessa Ribeiro, Rodrigo Valle, Priscilla Maracini, Aline Souza and Carolina Bertozzi.

ACKNOWLEDGEMENTS

Biological samples were obtained through the Santos Basin Beach Monitoring Project required by the federal environmental agency in Brazil (IBAMA), as part of the environmental licensing of PETROBRAS' activities in Santos Basin area, together with other monitoring programmes (further information can be obtained at <http://www.comunicabaciadesantos.com.br>). Aline Souza was supported by a scholarship from the International Cooperation Program CAPES/COFECUB at the Northern Rio de Janeiro University financed by CAPES—Brazilian Federal Agency for Support and Evaluation of Graduate Education within the Ministry of Education of Brazil.

CONFLICT OF INTEREST STATEMENT

The authors of this article declare that there are no conflicts of interest.

ETHICS STATEMENT

The animal was found dead, and according to Brazilian legislation, no ethical committee approval is required for carcass studies.

FUNDING INFORMATION

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

ORCID

Hassan Jerdy  <https://orcid.org/0000-0002-2373-2453>

REFERENCES

- Ramos RMA, Di Benedetto APM, Siciliano S, Santos MCO, Zerbini AN, Bertozzi C, et al. Morphology of the Franciscana (*Pontoporia blainvillei*) off southeastern Brazil: sexual dimorphism, growth and geographic variation. *Lat Am J Aquat Mamm.* 2002;1(1):129–44.
- Barbato BHA, Secchi ER, Di Benedetto APM, Ramos RMA, Bertozzi C, Marigo J, et al. Geographical variation in franciscana (*Pontoporia blainvillei*) external morphology. *J Mar Biol Assoc UK.* 2012;92(8):1645–56.
- Crespo EA, Harris G, González R. Group size and distributional range of the franciscana, *Pontoporia blainvillei*. *Mar Mamm Sci.* 1998;14(4):845–49.
- De Guise S, Lagacé A, Béland P. Tumors in St. Lawrence beluga whales (*Delphinapterus leucas*). *Vet Pathol.* 1994;31:444–49.
- Zerbini AN, et al. *Pontoporia blainvillei* (errata version published in 2018). The IUCN Red List of Threatened Species 2017. IUCN; 2017.
- Jaber JR, Pérez J, Arbelo M, Andrada M, Hidalgo M, Gómez-Villamandos JC, et al. Hepatic lesions in cetaceans in cetaceans stranded in the canary islands. *Vet Pathol.* 2004;41:147–53.
- Van Bressems M, Van Waerebeek K, Montes D, Kennedy S, Reyes J, Garcia-Godos I, et al. Diseases, lesions and malformations in the long-beaked common dolphin *Delphinus capensis* from the Southeast Pacific. *Dis Aquat Org.* 2006;68:149–65.
- Fauquier D, Gulland F, Haulena M, Spraker T. Biliary adenocarcinoma in a stranded northern elephant seal (*Mirounga angustirostris*). *J Wildl Dis.* 2003;39:723–26.
- Anderson WI, Steinberg H, Scott DW, King JM. Cutaneous squamous cell carcinoma and multiple epidermoid cysts in a California sea lion. *Aquat Mamm.* 1990;16:21–22.
- Martineau D, Lemberger K, Dallaire A, Labelle P, Lipscomb TP, Michel P, et al. Cancer in wildlife, a case study: beluga from the St. Lawrence estuary, Quebec, Canada. *Environ Health Perspect.* 2002;110(3):285–92.
- Geraci JR, Lounsbury VJ. Marine mammals ashore: a field guide for strandings. 2nd ed. Baltimore, USA: National Aquarium in Baltimore; 2005.
- Cullen JM. Tumors of the liver and gallbladder. In: Meuten DJ, editor. *Tumors in domestic animals.* 5th ed. Iowa: John Wiley & Sons Inc; 2017. p. 602–31.
- Trigo FJ, Thompson H, Breeze RG, Nash AS. The pathology of liver tumours in the dog. *J Comp Pathol.* 1982;92:21–39.
- Lawrence HJ, Erb HN, Harvey HJ. Nonlymphomatous hepatobiliary masses in cats: 41 cases (1972 to 1991). *Vet Surg.* 1994;23:365–68.
- Anderson WA, Davis CL, Monlux AW. A survey of tumors occurring in cattle, sheep, and swine. *Am J Vet Res.* 1956;17(65):646–77.
- Graw JJ, Berg H. Hepatocarcinogenetic effect of dena in pigs. *Cancer Res Clin Oncol.* 1977;89:137–43.
- Bastianello SS. A survey on neoplasia in domestic species over a 40-year period from 1935 to 1974 in the Republic of South Africa. I. Tumours occurring in cattle. *Onderstepoort J Vet Res.* 1982;49:195–204.
- Charles JA, Cullen JM, van den Ingh TS, Van Winkle T, Desmet VJ. Morphological classification of neoplastic disorders of the canine and feline liver. In: Rothuizen J, editor. *WSAVA standards for clinical and histological diagnosis of canine and feline liver diseases.* New York: Saunders; 2006. p. 117–24.
- Baba AI, Cătoi C. Tumors of the liver and gall bladder. In: *Comparative oncology.* Bucharest (RO): The Publishing House of the Romanian Academy; 2007.
- Bedossa P, Paradis V. In: Jarnagin WR, editor. *Blumgart's surgery of the liver, biliary tract and pancreas.* 6th ed. Vol. 2. Elsevier; 2017. p. 1272–98.
- Wang ZB, Guo Y, Yuan J, Zhao P, Shi H-Y. Intrahepatic cholangiocarcinoma arising from bile duct adenoma. *Int J Clin Exp Pathol.* 2016;9(10):10036–43.
- Hendricks JD, Meyers TR, Shelton DW. Histological progression of hepatic neoplasia in rainbow trout (*Salmo gairdneri*). *J Natl Cancer Inst.* 1984;65:321–36.
- Parland WK, Baumann PC. Pathology and tumor development through time in guppies dosed with diethyl-nitrosamine (DEN). *J Appl Toxicol.* 1985;5:265–72.
- Couch JA, Courtney LA. N-nitrosodiethylamine-induced hepatocarcinogenesis in estuarine sheepshead minnow (*Cyprinodon variegatus*): neoplasms and related lesions compared with mammalian lesions. *J Natl Cancer Inst.* 1987;79:297–321.
- Grizzle JM, Thiyagarajah A. Diethylnitrosamine-induced hepatic neoplasms in the fish *Rivulus ocellatus marmoratus*. *Dis Aquat Org.* 1988;5:39–50.
- Hawkins WE, Walker WW, Overstreet RM, Lytle TF, Lytle JS. Dose-related carcinogenic effects of water-borne benzo[a]pyrene on livers of two small fish species. *Ecotoxicol Environ Saf.* 1988;16:219–23.
- Law JM, Hawkins WE, Overstreet RM, Walker WW. Hepatocarcinogenesis in western mosquitofish (*Gambusia affinis*) exposed to methylazoxymethanol acetate. *J Comp Pathol.* 1994;110:117–27.
- Boorman GA, Botts S, Bunton TE, Fournie JW, Harshbarger JC, Hawkins WE, et al. Diagnostic criteria for degenerative, inflammatory, proliferative nonneoplastic and neoplastic liver lesions in medaka (*Oryzias latipes*): consensus of a National Toxicology Program pathology working group. *Toxicol Pathol.* 1997;25:202–10.
- Allison JB, Robertson WB. Some effects of 2-acetylaminofluorene on the dog. *Cancer Res.* 1950;10:266–71.
- Graw JJ, Berg H. Hepatocarcinogenetic effect of dena in pigs. *Zeitschrift für Krebsforschung und klinische Onkologie.* *Cancer Res Clin Oncol.* 1977;89:137–43.
- Castello HP. Análisis de Contaminantes Organoclorados y Metales Pesados en Franciscana, *Pontoporia blainvillei*, de Argentina y Brasil. Report of the third workshop for coordinated research and conservation of the Franciscana dolphin (*Pontoporia blainvillei*) in the Southwestern Atlantic. Bonn: UNEP/CMS; 2000. p. 46–50.
- Kajiwarra N, Matsuoka S, Iwata H, Tanabe S, Rosas FCW, Fillmann G, et al. Contamination by persistent organochlorines in cetaceans incidentally caught along Brazilian coastal waters. *Arch Env Contam Toxic.* 2004;46:124–34. <https://doi.org/10.1007/s00244-003-2239-y>
- Yogui GT, Santos MCO, Bertozzi CP, Montone RC. Levels of persistent organic pollutants and residual pattern of DDTs in small cetaceans from the coast of São Paulo, Brazil. *Mar Pollut Bull.* 2010;60:1862–67.
- Lailson-Brito J, Dorneles PR, Azevedo-Silva CE, De Freitas Azevedo A, Vidal LG, Marigo J, et al. Organochlorine concentrations in franciscana dolphins, *Pontoporia blainvillei*, from Brazilian waters. *Chemosphere.* 2011;84:882–87. <https://doi.org/10.1016/j.chemosphere.2011.06.018>
- Alonso MB, Eljarrat E, Gorga M, Secchi ER, Bassoi M, Barbosa L, et al. Natural and anthropogenically-produced brominated compounds in endemic dolphins from Western South Atlantic: another risk to a vulnerable species. *Environ Pollut.* 2012;170:152–60.

36. Alonso MB, Feo ML, Corcellas C, Gago-Ferrero P, Bertozzi CP, Marigo J, et al. Toxic heritage: maternal transfer of pyrethroid insecticides and sunscreen agents in dolphins from Brazil. *Environ Pollut*. 2015;207:391–402. <https://doi.org/10.1016/j.envpol.2015.09.039>
37. Dorneles PR, Sanz P, Eppe G, Azevedo AF, Bertozzi CP, Martínez MA, et al. High accumulation of PCDD, PCDF, and PCB congeners in marine mammals from Brazil: a serious PCB problem. *Sci Total Environ*. 2013;463–464:309–18. <https://doi.org/10.1016/j.scitotenv.2013.06.015>
38. Chaloupka K, Harper N, Krishnan V, Santostefano M, Rodriguez LV, Safe S. Synergistic activity of polynuclear aromatic hydrocarbon mixtures as aryl-hydrocarbon (ah) receptor agonists. *Chem Biol Interact*. 1993;89:141–58.
39. Kuriyama SN, Talsness CE, Grote K, Chahoud I. Developmental exposure to low-dose PBDE-99: effects on male fertility and neurobehavior in rat offspring. *Environmental Health Perspect*. 2005;113:149–54.
40. Schechter A, Birnbaum L, Ryan JJ, Constable JD. Dioxins: an overview. *Environ Res*. 2006;101:419–28.
41. Shafer T. Complete inhibition of spontaneous activity in neuronal networks in vitro by deltamethrin and permethrin. *Neurotoxicology*. 2008;29:203–12.
42. Scollon EJ, Starr JM, Crofton KM, Wolansky MJ, Devito MJ, Hughes MF. Correlation of tissue concentrations of the pyrethroid bifenthrin with neurotoxicity in the rat. *Toxicology*. 2011;290:1–6. <https://doi.org/10.1016/j.tox.2011.08.002>
43. Secchi ER, Cremer MJ, Danilewicz D, Lailson-Brito J. A synthesis of the ecology, human-related threats and conservation perspectives for the endangered Franciscana dolphin. *Front Mar Sci*. 2021;8:617956. <https://doi.org/10.3389/fmars.2021.617956>
44. Monteiro F, Lemos LS, De Moura JF, Rocha RCC, Moreira I, Di Benedetto APM, et al. Total and subcellular Ti distribution and detoxification processes in *Pontoporia blainvillei* and *Steno bredanensis* dolphins from Southeastern Brazil. *Mar Pollut Bull*. 2020;153:110975. <https://doi.org/10.1016/j.marpolbul.2020.110975>

How to cite this article: Jerdy H, Ribeiro V, Souza A, Valle R, Maracini P, Bertozzi C, et al. Cholangiocellular adenoma in Franciscana dolphins (*Pontoporia blainvillei*). *Vet Rec Case Rep*. 2023;e770. <https://doi.org/10.1002/vrc2.770>

IMAGE QUIZ

Well-formed bile ducts, lined with a single layer of well-differentiated and homogeneous cells.

MULTIPLE-CHOICE QUESTION

Which tumour matches the description above?

POSSIBLE ANSWERS TO MULTIPLE-CHOICE QUESTION

- a. Hepatocellular carcinoma
- b. Cirrhosis
- c. Cholangiocellular adenoma
- d. Hemangioma

CORRECT ANSWER

(c) Cholangiocellular adenoma

Of the alternatives, only cholangiocellular adenomas present a layer of cells in bile ducts and no pleomorphism or other malignancy signs.