

# Intra-abdominal mass in a cat

## Contributors

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## Specimen

Fine-needle aspiration cytology samples obtained from an intra-abdominal mass of undetermined organ origin.

## Signalment

12-year-old spayed female domestic shorthair cat.

## History

The cat was presented for excessive licking of the ventral abdomen resulting in alopecia.

## Clinical findings

On physical examination, the cat was bright, alert, and responsive. Vital parameters were within normal limits. Symmetrical alopecia was noted on the ventral abdomen and the medial aspects of all limbs.

A complete blood count (XN-V Haematology Analyzer, Sysmex Corporation, Kobe, Japan) was unremarkable, except for a borderline decrease in reticulocyte haemoglobin content (15.2 pg; reference interval [RI]: 15.3 – 22.9 pg). A biochemistry panel (Beckman Coulter AU5800, Brea, CA, USA) revealed a mild increase in lipase activity (49 U/L; RI 0.0 – 45.0 U/L). Serum fructosamine and total thyroxine (T4) levels (Siemens Immulite 2000, Siemens Healthineers, Erlangen, Germany) were within the reference interval.

Abdominal ultrasound revealed an irregular, rounded mass with mildly heterogeneous echotexture located in the mid-cranial abdomen, measuring approximately 30 x 40 mm (**Figure 1**). Based on ultrasonographic findings, no clear association with any abdominal organ could be established. Abdominal lymph node enlargement was suspected, possibly due to neoplasia, particularly lymphoma.

Fine-needle aspiration samples of the intra-abdominal mass were collected and submitted to an external laboratory (IDEXX Laboratories, Kornwestheim, Germany) for cytologic evaluation.

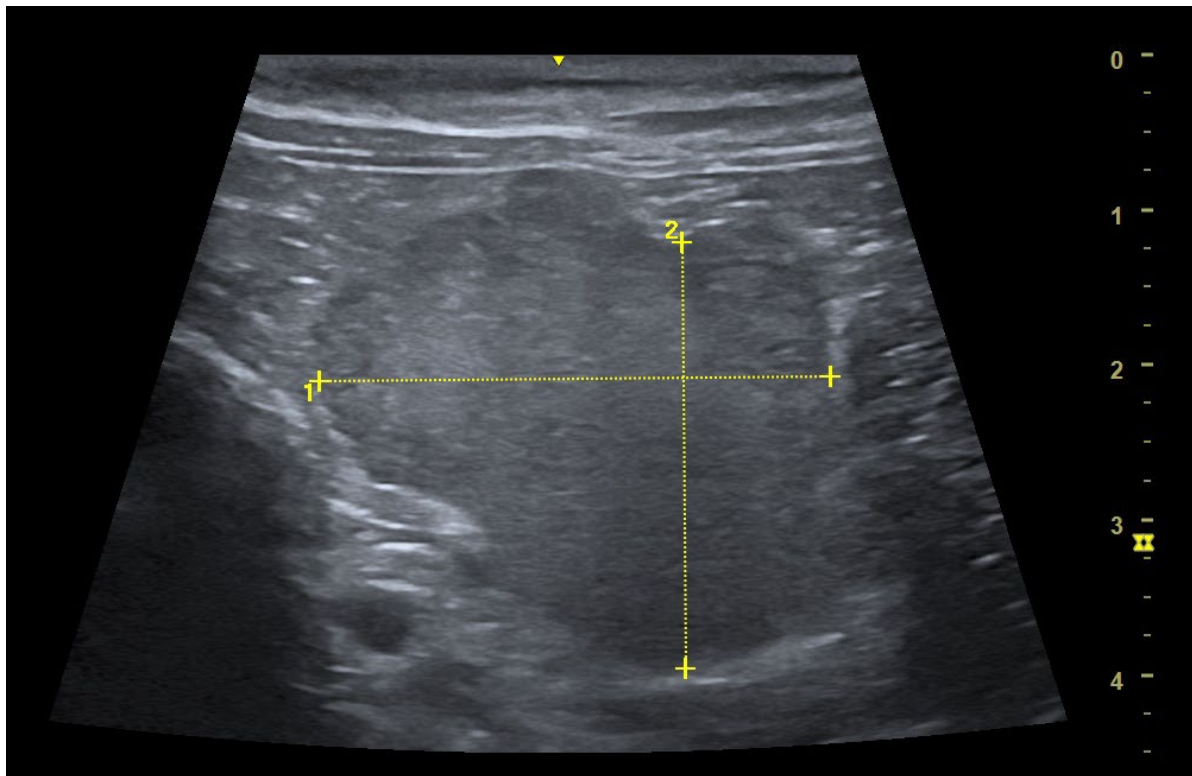


**Figure 1.** Abdominal ultrasonography showing an approximately 30 x 40 mm mass in the mid-cranial abdomen. Anatomic origin could not be determined.

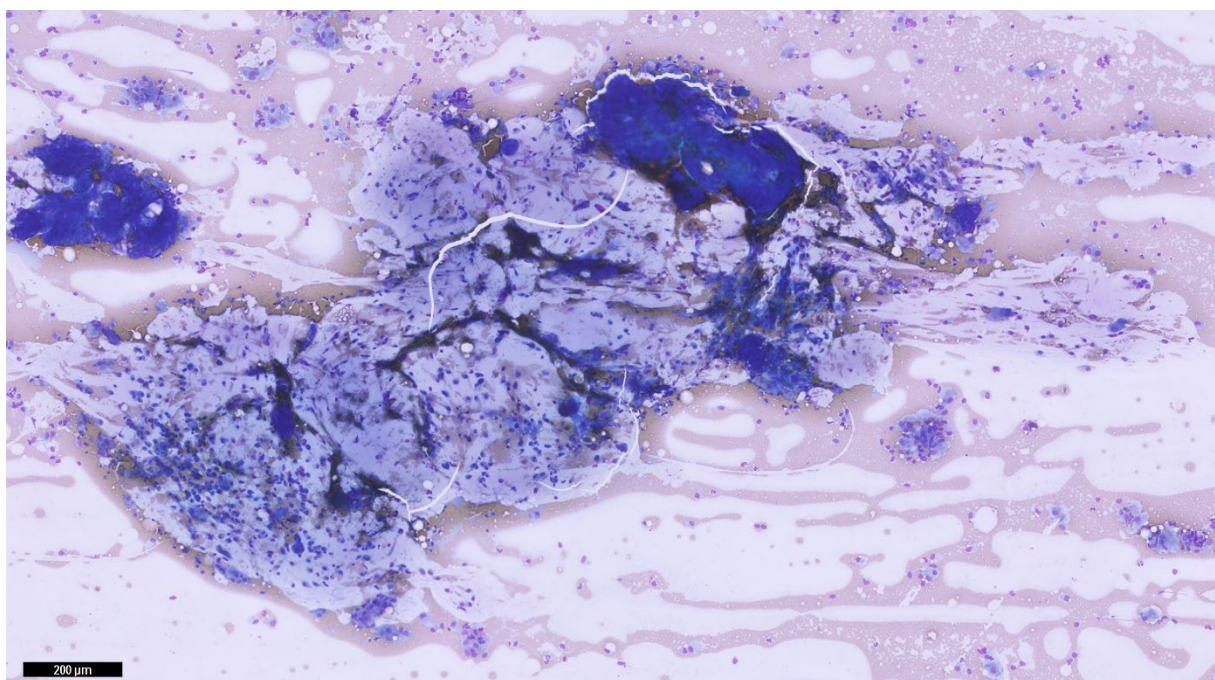


**Figure 2.** Fine-needle aspiration of an intra-abdominal mass, 50x magnification (May-Grünwald-Giemsa)

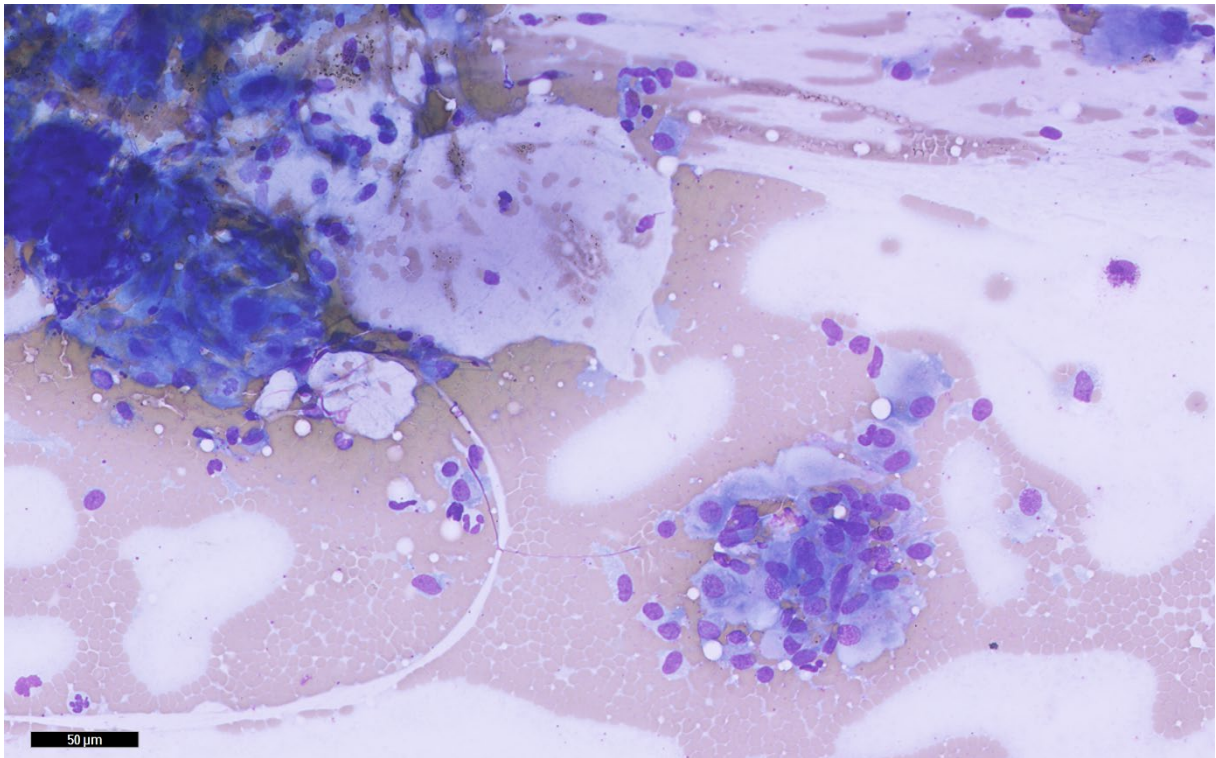


**Figure 3.** Fine-needle aspiration of an intra-abdominal mass, 200x magnification (May-Grünwald-Giemsa)

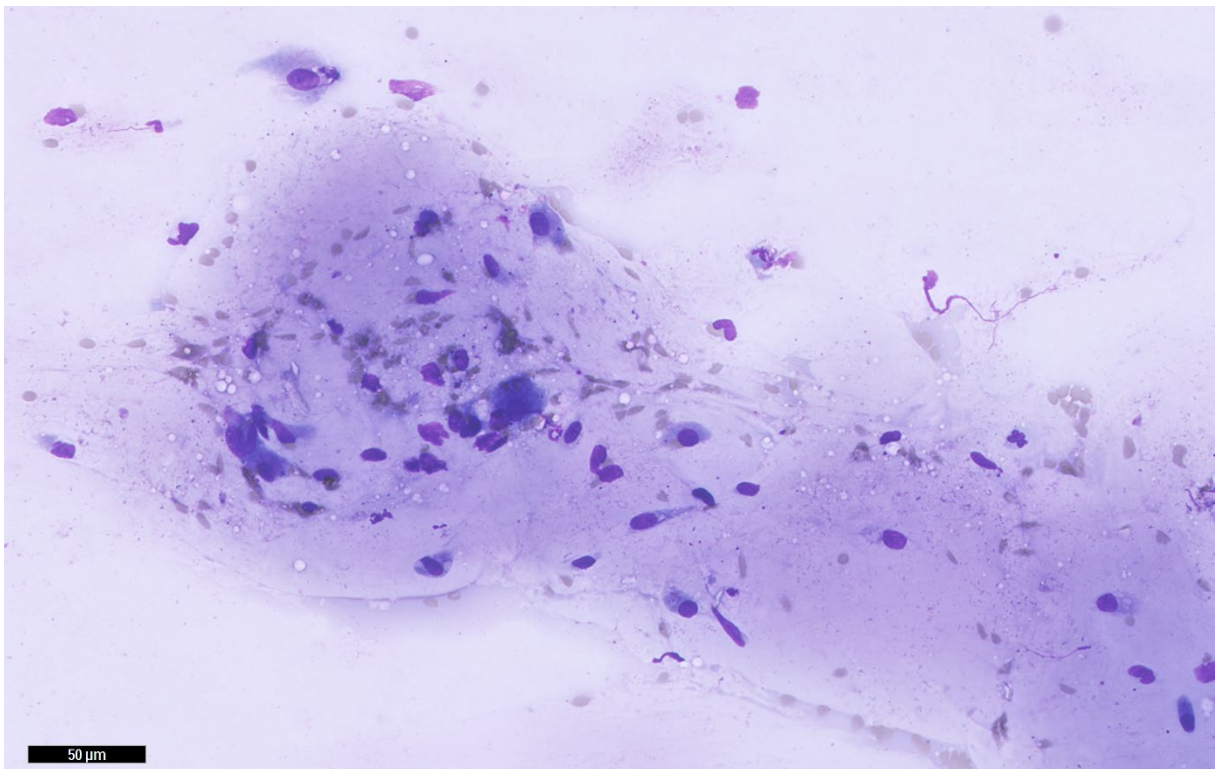


**Figure 4.** Fine-needle aspiration of an intra-abdominal mass, 200x magnification (May-Grünwald-Giemsa)

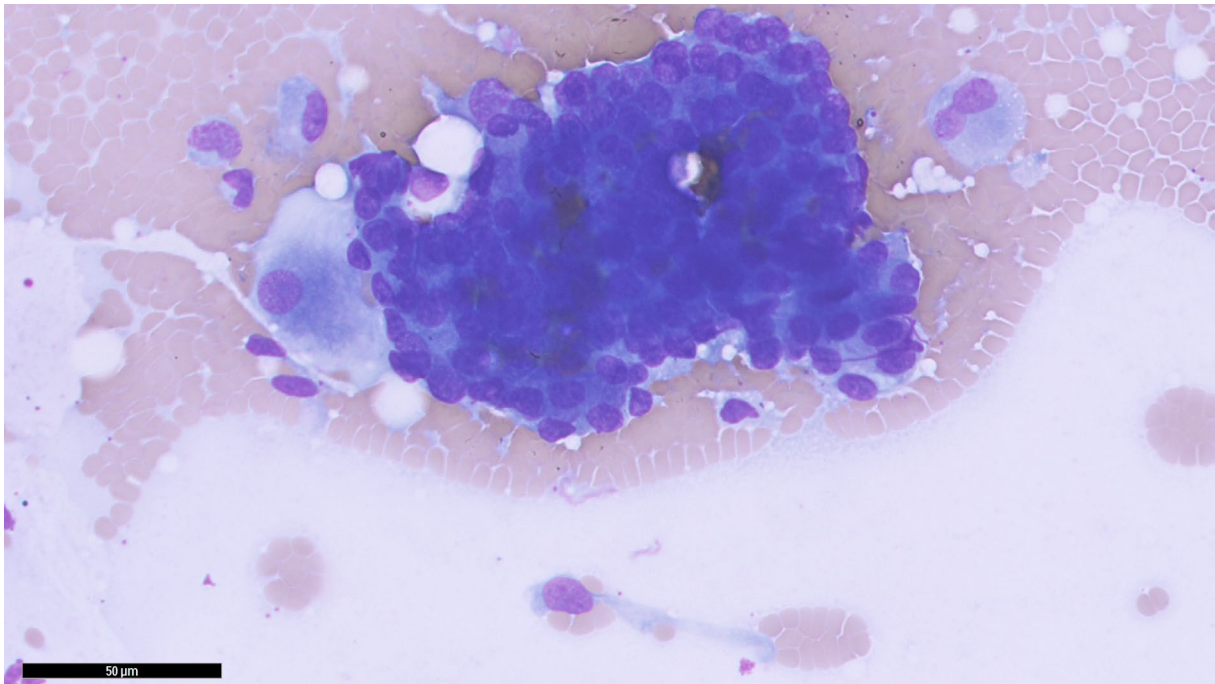


**Figure 5.** Fine-needle aspiration of an intra-abdominal mass, 400x magnification (May-Grünwald-Giemsa)

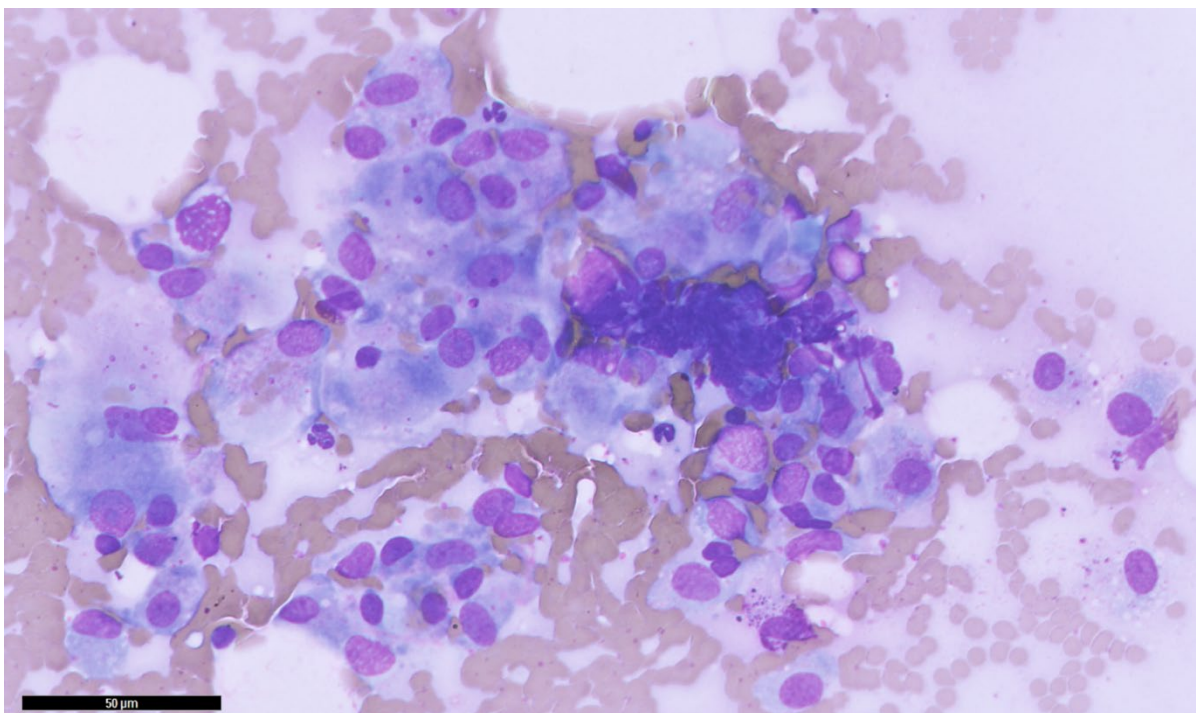


**Figure 6.** Fine-needle aspiration of an intra-abdominal mass, 400x magnification (May-Grünwald-Giemsa)

## **Cytologic description**

Preparations were of moderate to high nucleated cellularity and good preservation. The background was lightly basophilic and moderately to markedly bloody. Abundant extracellular, lightly basophilic, mucoid, viscous, streaming material was present, with entrapped cells displaying windrowing. (**Figure 2, 3, 4**) Numerous epithelial cells exfoliated predominantly in small cohesive clusters with a cobblestone arrangement and, less frequently, individually. (**Figure 5**) A proportion of cells showed a tubular growth pattern with single centrally located round to oval nuclei, reticulated chromatin, occasionally visible nucleoli, and small amounts of lightly basophilic, cuboidal cytoplasm. These cells exhibited a high nuclear to cytoplasmic ratio. Additionally, numerous polygonal to triangular and rarely spindle shaped cells were observed, predominantly individualized and rarely in loosely cohesive clusters. (**Figure 4 and 6**) These cells contained paracentrally to eccentrically located round to oval nuclei with reticulated to finely clumped chromatin, single to multiple indistinct nucleoli, and moderate to large amounts of wispy, lightly basophilic cytoplasm with indistinct cell borders. Fine to coarse pink cytoplasmic granules were commonly observed (**Figure 6**). Rarely, well-demarcated vacuoles were present (not depicted). The cells demonstrated moderate to marked anisocytosis, moderate anisokaryosis, and frequent binucleation to multinucleation. Low numbers of activated macrophages, non-degenerate neutrophils, small lymphocytes and eosinophils were noted.

## **Answers to questions**

### **1. How would you describe the origin of the extracellular material observed on the slides?**

The amorphous, lightly basophilic material shows signs of viscosity, as indicated by focal cellular streaming (windrowing), and exhibits an overall mucoid appearance. Therefore, both mucinous secretion and myxoid extracellular matrix formation were cytologically considered for this material. Based on its colour, amyloid, "white" bile, and other non-specific amorphous material are also among the differentials.

### **2. Based on the cytologic picture, what are your top differential diagnoses for the aetiology of the mass and its site of origin?**

Epithelial proliferation, mild mesenchymal proliferation, mild mixed inflammation and large amounts of mucinous extracellular material. A mucus producing epithelial neoplasia (mucinous adenoma/adenocarcinoma) was the primary differential diagnosis. Possible sites of origin were the gastrointestinal tract and the pancreas.

## **Detailed interpretation/diagnosis**

The cytologic interpretation was most consistent with epithelial proliferation, with concurrent mesenchymal proliferation, mucoid material of uncertain origin, and mild mixed inflammation.

The combination of epithelial proliferation and abundant mucoid material was suggestive of a mucus-producing cell proliferation, with neoplasia considered most likely (e.g., mucinous adenocarcinoma, less likely adenoma). The intestine and pancreas were deemed most probable as sites of origin; however, no definitive morphologic identification was possible. As some of the cells showed features overlapping with a mesenchymal proliferation (e.g., indistinct cell borders, polygonal to spindle shape) a mesenchymal cell origin was additionally considered. However, in the overall context an undifferentiated epithelial cell population appeared more likely.

The absence of lymphoid tissue in the specimen did not support the initial suspicion of lymphoma, although a metastatic process with complete effacement of the lymphatic tissue could not be excluded.

### 3. What further diagnostic tests do you think could be helpful in this case?

Advanced diagnostic imaging (e.g., computed tomography) may help to determine the organ of origin as well as potential organ invasion and metastasis. Exploratory laparotomy with biopsy is recommended for comprehensive evaluation.

To further characterize the mucoid material, special stains such as mucin stains (e.g., Alcian blue, Mucicarmine), periodic acid-Schiff (PAS) or Congo red may be applied.

### Additional Information

Following cytologic evaluation, an exploratory laparotomy was performed. A single irregular mass was identified arising from the distal aspect of the left pancreatic lobe. No additional macroscopic abnormalities were observed. Excisional biopsy of the mass was submitted to an external laboratory (IDEXX Laboratories, Kornwestheim, Germany) for histopathologic examination.

Histopathology revealed a nodular, non-encapsulated, well- to moderately demarcated mass that mildly infiltrated the surrounding pancreatic tissue (**Figure 7**). Neoplastic epithelial cell clusters, partially arranged in a tubuloacinar pattern and multifocally forming solid nests, were embedded within abundant pale eosinophilic hyaline to mucinous extracellular material (**Figure 8**). The neoplastic cells were polygonal with moderate amounts of eosinophilic, occasionally granular cytoplasm with indistinct cell borders. Nuclei were round to oval, moderately heterochromatic and contained a single, occasionally prominent nucleolus. Anisocytosis and anisokaryosis were mild to moderate with 4 mitotic figures counted in 2.37 mm<sup>2</sup> (10 high-power fields x400). Multifocally, the neoplastic cells were supported by a collagen-rich stroma. No evidence of vascular or lymphatic invasion was detected. Complete excision was achieved with tumour-free margins.

On cytologic preparations, the extracellular material was negative for Alcian blue.

On histologic preparations, the material showed strong positivity for PAS (**Figure 9**) and diffuse positivity for Alcian blue (**Figure 10**), while yielding negative results for Congo red (not depicted) and mucicarmine (**Figure 11**).

Cytologic mucicarmine staining could not be reliably evaluated due to technical issues with the staining solution.

### Histopathological interpretation/diagnosis

The initial histopathological diagnosis, based on H&E-stained slides, was exocrine pancreatic carcinoma, hyalinizing subtype. Special stains (Congo red, Alcian blue, mucicarmine) were still pending at that time.

Based on the positive PAS and Alcian blue staining, pancreatic colloid carcinoma was subsequently added to the list of differential diagnoses.

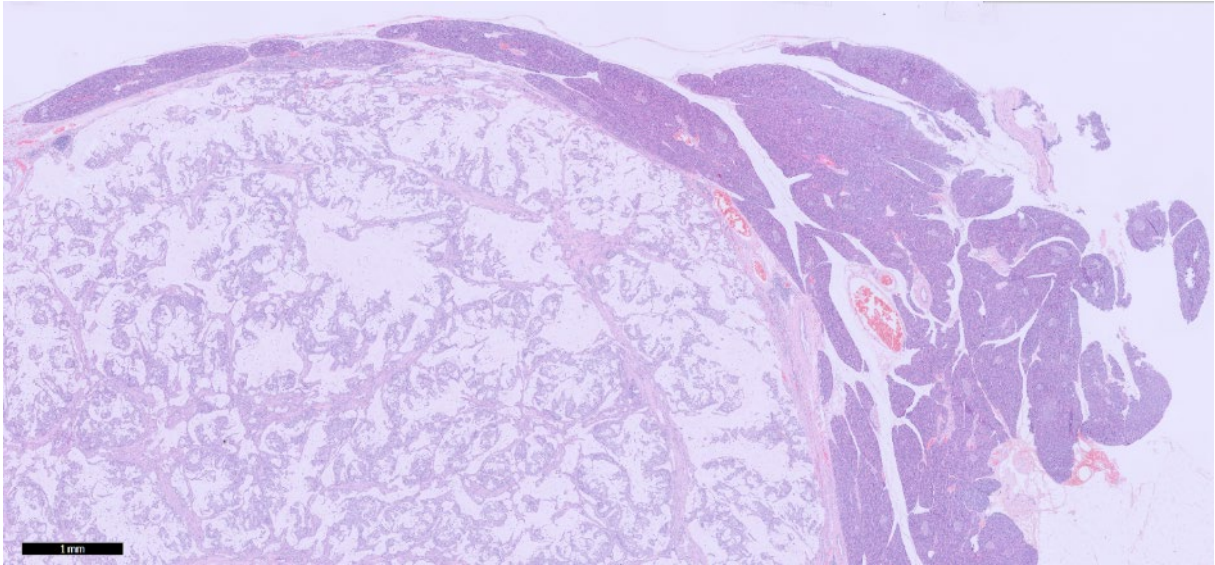


**Figure 7.** Histopathology of the pancreatic mass, 10x magnification (H&E stain)

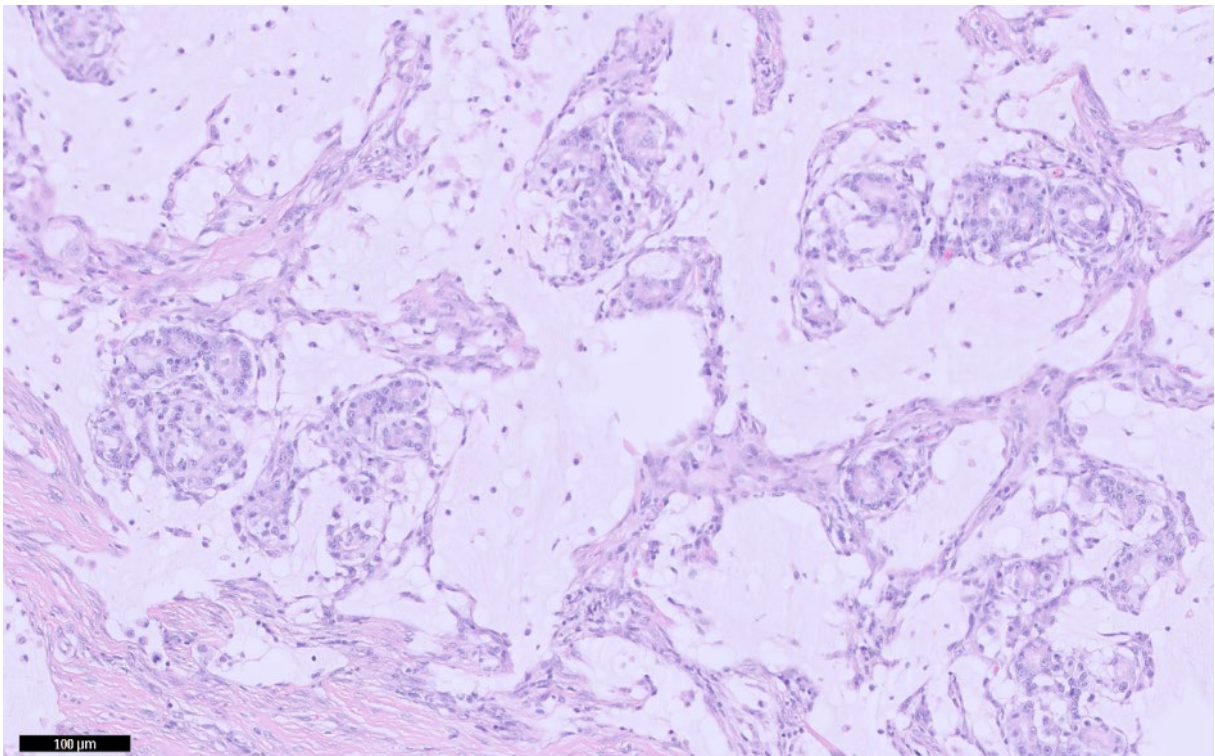


**Figure 8.** Histopathology of the pancreatic mass, 100x magnification (H&E)

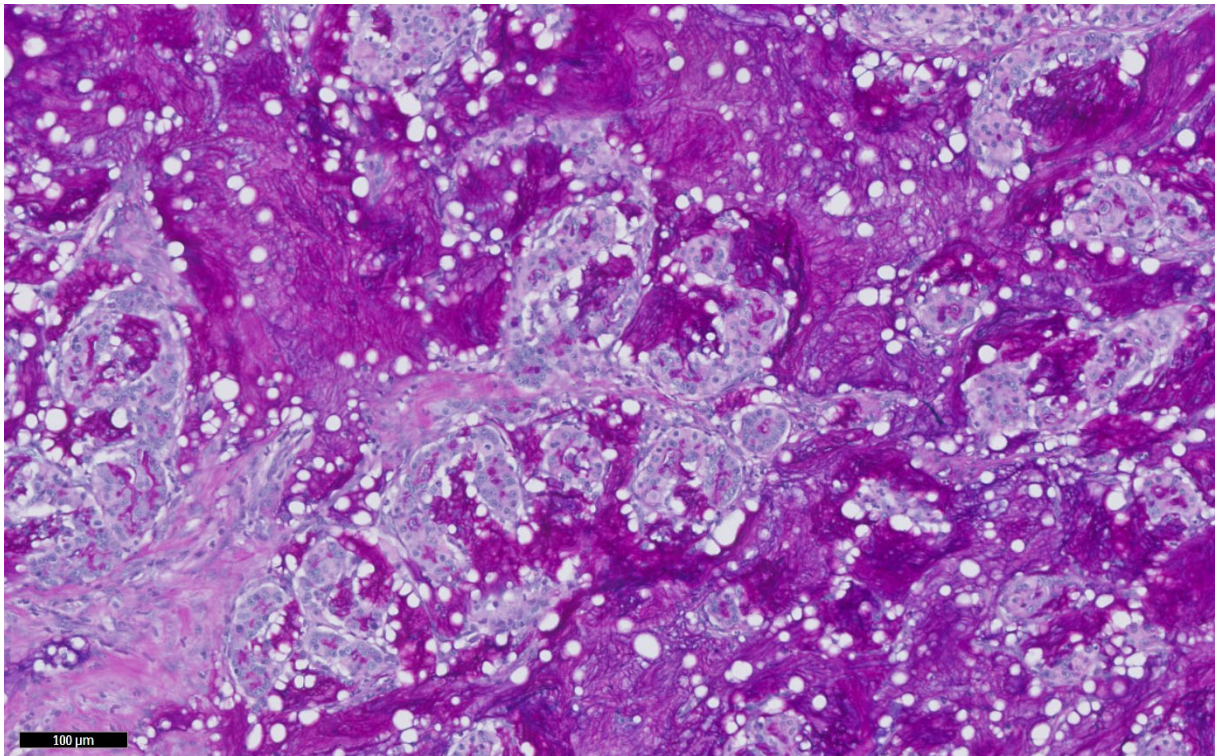


**Figure 9.** Histopathology of the pancreatic mass, 100x magnification (PAS stain).

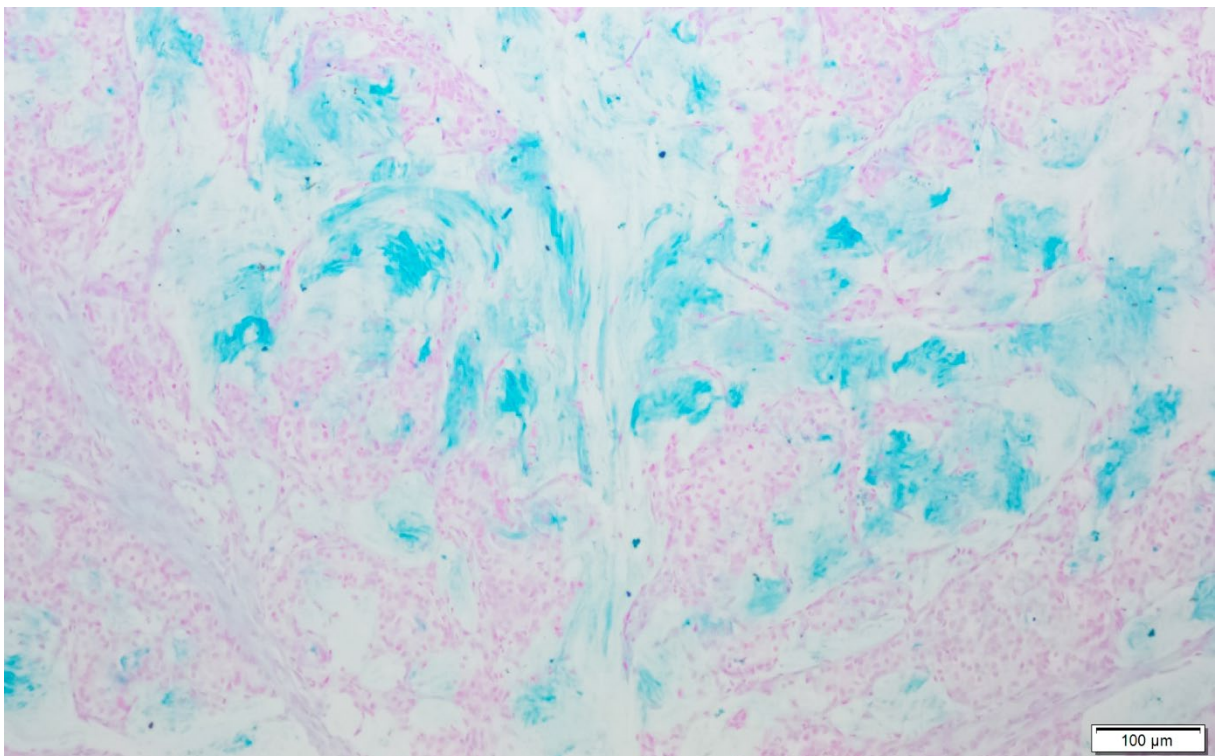


**Figure 10.** Histopathology of the pancreatic mass, 100x magnification (Alcian blue stain).

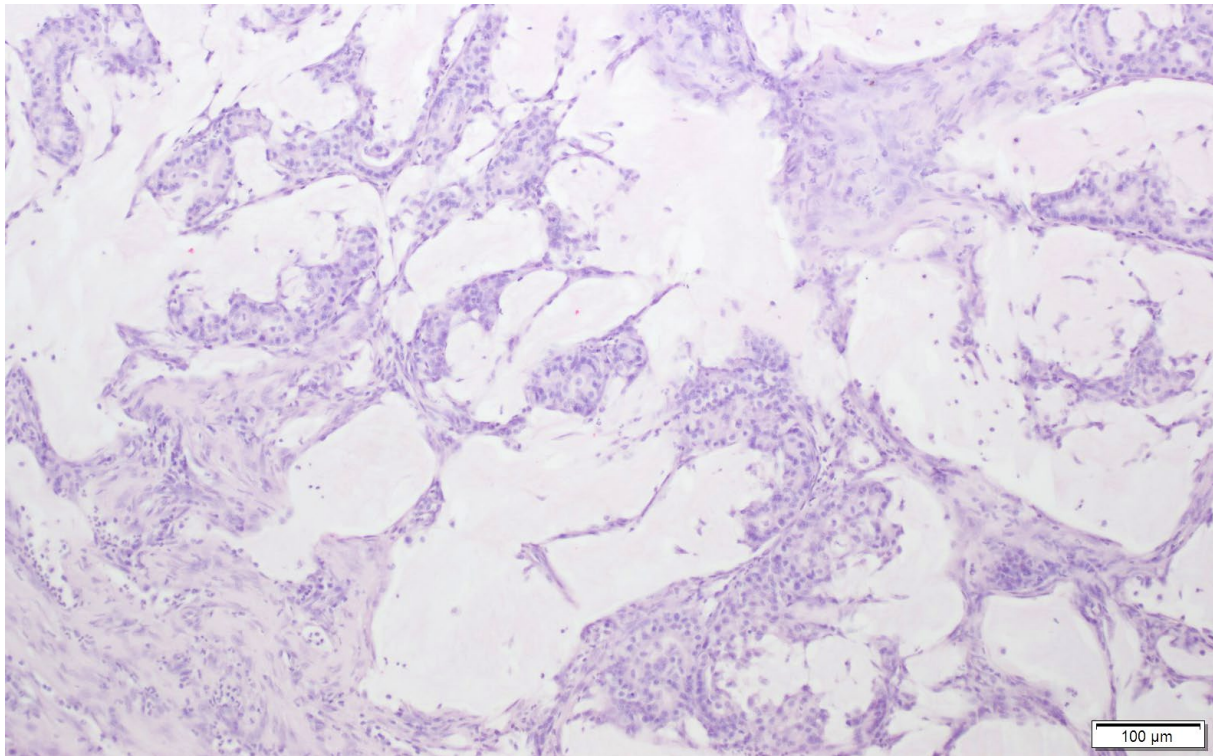


**Figure 11.** Histopathology of the pancreatic mass, 100x magnification (mucicarmine stain).

### Follow-up and clinical outcome

The cat recovered well from surgery and was discharged on oral analgesic medication (meloxicam). She remained in good general condition and maintained good appetite. At the time of writing (two weeks postoperatively), there was no evidence of hair regrowth in the alopecic areas. No information was available regarding continued licking of the abdomen or limbs. As the case was only recently processed, no long-term follow-up could be obtained at the time of abstract preparation.

### Discussion

Tumour-like changes of the exocrine pancreas are relatively common in older cats. These lesions are most often hyperplastic rather than neoplastic in nature. Neoplasia of the exocrine pancreas is uncommon in this species. The majority of tumours constitute carcinomas, with an incidence of less than 0.5 %.<sup>1,2,4</sup> Pancreatic carcinomas are most commonly diagnosed in middle-aged to older cats with a median age of 11.6 years. Nonspecific but frequent clinical signs such as weight loss, anorexia, and vomiting, and less commonly a palpable abdominal mass or icterus are presenting signs. Paraneoplastic glabrous alopecia has been reported in some cats with carcinomas of the pancreas, but has also been described in association with carcinomas of the liver, bile ducts and intestine, as well as with pancreatic neuroendocrine carcinomas and hepatosplenic plasma cell tumours.<sup>3</sup> The alopecia primarily affects the face, ventral abdomen and medial aspects of the limbs and may be reversible following surgical excision of the neoplasm.<sup>2,4</sup> At the time of diagnosis, pancreatic carcinomas typically present as solitary lesions exceeding 1 cm in diameter. A predilection site within the pancreas has not been reported, although some case studies have described an increased occurrence in the left pancreatic lobe.<sup>2,5</sup> Metastatic disease is common (up to 80 % of cats) and most frequently involves the liver, as well as regional lymph nodes and the lungs. Invasion into the small

intestine is common. Prognosis is poor, with median survival times (MST) of 6-7 days without treatment and 165 days with treatment.<sup>2</sup>

Based on histopathologic characteristics, pancreatic carcinomas in veterinary medicine can be classified as acinar, tubular/ductal, mixed, clear-cell, undifferentiated and hyalinized, with acinar or ductal differentiation being most commonly observed in the cat.<sup>1,6,7</sup> Other rare subtypes reported in cats include colloid (mucinous non-cystic) carcinoma and squamous cell carcinoma.<sup>8</sup> The prognostic relevance of tumour subtyping and histopathological evaluation of cellular differentiation has not been established and remains insufficiently investigated in clinical studies.<sup>1</sup>

In veterinary medicine, reports of the hyalinizing subtype of pancreatic adenocarcinoma are very rare. It is best described in the dog, but even in this species it appears to be an uncommon variant.<sup>9,10</sup> In a small case series with six dogs, histopathologic examination of this subtype revealed tubular and acinar structures lined by neoplastic epithelial cells, with lakes and globular aggregates of extracellular eosinophilic hyaline material filling both the lumina of the tubules and the tumour stroma.<sup>10</sup> Neoplastic cells exhibited mild anisocytosis and nuclear pleomorphism, suggesting low-grade malignancy. In dogs, the origin of the hyaline material remains undetermined. Staining with PAS, mucicarmine and Congo red were negative, thereby excluding amyloid and providing no evidence of a mucinous component. Immunohistochemical (IHC) staining for laminin and collagen showed negative to weakly positive results, respectively, further excluding connective tissue as a primary component. Lastly, IHC for  $\alpha$ 1-antitrypsin was also negative, a marker that may be expressed in accumulated hyaline material seen in clear-cell carcinomas in various organs, such as the ovary and salivary gland. Thus, the material was solely classified as hyaline based on its morphologic appearance. However, it should be noted that Alcian blue staining was not performed, and the presence of acidic mucins can therefore not be definitively excluded.

In the study from Dennis et al., survival times ranged from a few days up to 16 months without treatment and exceeded 19 months following partial pancreatectomy.<sup>10</sup> Metastases were observed only in one out of six dogs, which survived for 16 months after diagnosis. Mortality and euthanasia were primarily attributed to concurrent comorbidities, pancreatitis and postoperative complications. Based on the results of this study and considering that survival times in dogs with other variants of pancreatic adenocarcinoma range from 1 day to 19 weeks, it was postulated that hyalinizing pancreatic adenocarcinomas may exhibit a less aggressive biological behaviour than other subtypes.<sup>10,11</sup> Nevertheless, a case report by Hagelskamp et al. described a 10-year-old dog with histologically diagnosed hyalinizing pancreatic adenocarcinoma that developed a paraneoplastic syndrome characterized by pancreatitis, panniculitis, polyarthritis (PPP) and osteomyelitis, indicating that this variant may also be associated with potentially life-threatening complications beyond metastatic disease in dogs.<sup>12</sup>

To the authors' knowledge, only one report of a hyalinizing pancreatic adenocarcinoma in a cat was published to date.<sup>9</sup> A 6-year-old female spayed domestic shorthair cat was presented for palpable masses in the abdomen. Cytologic examination revealed clusters of mildly atypical epithelial cells embedded in abundant extracellular mucoid material, resembling the cytologic appearance observed in the current case. Complete excision was precluded by the masses' close association with the hepatic, pancreatic and splenic vasculature and incisional biopsies were obtained. The histological findings were consistent with those reported by Dennis et al., supporting a diagnosis of the hyalinizing variant of pancreatic adenocarcinoma. However, although Congo red staining was negative, neither mucin stains nor PAS staining were performed in this report, limiting the confidence in the final subtype classification. The cat was

discharged without additional treatment and remained clinically stable, with no reported deterioration 28 months after the initial diagnosis, suggesting a potentially low degree of biological aggressiveness.

Colloid carcinoma is a well-recognized subtype of pancreatic carcinoma in human medicine, which has very rarely been reported in cats.<sup>13,14,15</sup> Hagiwara et al. reported a case of a 21-year-old neutered female domestic shorthair cat with a pancreatic mass of gelatinous consistency.<sup>14</sup> Histopathological examination revealed abundant mucinous stroma surrounding and embedding neoplastic epithelial cells. The material was positive for Alcian blue and mucicarmine staining, leading to a diagnosis of a mucin-producing neoplasm, with colloid carcinoma being the most likely differential diagnosis.

In human pancreatic neoplasia, the presence and nature of extracellular material provide important diagnostic information. Well-described pancreatic neoplasms characterized by abundant extracellular mucin include mucinous cystic neoplasms (MCNs), intraductal papillary mucinous neoplasms (IPMNs) and colloid carcinoma.<sup>16</sup> While MCNs and IPMNs have been described as potential precursor lesions of malignant tumours, colloid carcinoma represents a subtype of pancreatic ductal adenocarcinoma. Nevertheless, colloid carcinoma has been associated with a more favourable overall prognosis compared to other malignant pancreatic neoplasms, highlighting the importance of precise histopathological classification in human medicine.<sup>16</sup> The canine subtype of hyalinizing pancreatic adenocarcinoma is not currently recognized in the WHO classification.<sup>17</sup>

The present case demonstrates cytological and histopathological features consistent with rarely described variants of pancreatic adenocarcinoma in the cat.

As illustrated, extracellular material of unknown origin portrays a diagnostic challenge in cytological and histopathological samples, as it can morphologically mimic various entities, including mucin, amyloid, collagen and others. Cytochemical or histochemical methods are often required to further investigate its origin and subsequently better assess the nature, aetiology and biological behaviour of the underlying process.

In both feline cases reported by Chan et al. and Hagiwara et al., as well as in the present case, Congo red staining was performed and yielded negative results, thereby excluding amyloid as the source of the material.<sup>9,14</sup> Mucicarmine staining was only performed in the case of colloid carcinoma.<sup>14</sup> Consequently, some caution is warranted regarding the diagnosis of hyalinizing pancreatic carcinoma.<sup>9</sup>

PAS and Alcian blue staining of a histologic preparation were positive in the present case, supporting the presence of a mucinous component within the extracellular material. This finding is consistent with the reported features of colloid pancreatic carcinoma described by Hagiwara et al., making it a likely differential diagnosis here.<sup>14</sup> In contrast to the case described by Hagiwara et al., mucicarmine staining yielded negative results in the present case, therefore precluding a definitive diagnosis of colloid carcinoma. Given the scarcity of reported cases, a varying composition of mucins within these lesions cannot be ruled out.

In contrast to the histologic staining, Alcian blue staining of the cytologic preparations yielded negative results. It should be noted that the staining was performed on pre-stained cytologic smears (May–Grünwald–Giemsa) using a protocol primarily used for histologic specimens. Therefore, differences in staining conditions may have influenced the results. Further investigation is warranted to determine the diagnostic utility of cytologic staining for extracellular material of uncertain origin in such cases.

In summary, this case illustrates the presence of extracellular material in a pancreatic neoplasm of a cat, initially identified in cytology and subsequently confirmed as a key diagnostic feature in histopathology. Feline pancreatic adenocarcinoma is rare, and the prognostic impact of histopathological subtyping has not been scientifically established in veterinary medicine. However, a previously reported case consistent with a hyalinizing variant of feline pancreatic adenocarcinoma demonstrated long-term survival despite incomplete tumour resection and the absence of additional treatment. In humans, the colloidal subtype also shows a prolonged survival; however, due to the scarcity of cases its prognostic significance still remains to be determined in cats.

To gather more information on this question, the presence of extracellular material in cytologic samples of pancreatic lesions should be carefully documented and considered in cytology reports, while histopathological examination remains the diagnostic method of choice. Cytochemical and histochemical stains may further aid in differentiating extracellular material of unknown origin and contribute to a more refined diagnosis.

### **Conflict of interest statement**

The authors declare that they have no conflict of interest.

### **References**

- <sup>1</sup> Munday JS, Löhr CV, Kiupel M. Tumors of the alimentary tract. In: Meuten DJ, editor. Tumors of domestic animals. 5th ed. St. Louis: Elsevier; 2017. p. 499-601.
- <sup>2</sup> Linderman, M. J.; Brodsky, E. M.; Lorimier, L-P de; Clifford, C. A.; Post, G. S. (2013): Feline exocrine pancreatic carcinoma: a retrospective study of 34 cases. In: *Veterinary and comparative oncology* 11 (3), S. 208–218.
- <sup>3</sup> Grandt, Lisa-Maria; Roethig, Anja; Schroeder, Sabrina; Koehler, Kernt; Langenstein, Judith; Thom, Nina; Neiger, Reto (2015): Feline paraneoplastic alopecia associated with metastasising intestinal carcinoma. In: *JFMS open reports* 1 (2), 2055116915621582. DOI: 10.1177/2055116915621582.
- <sup>4</sup> Seaman, Rebecca L. (2004): Exocrine pancreatic neoplasia in the cat: a case series. In: *Journal of the American Animal Hospital Association* 40 (3), S. 238–245. DOI: 10.5326/0400238.
- <sup>5</sup> Nicoletti R, Chun R, Curran KM, *et al.* Postsurgical Outcome in Cats with Exocrine Pancreatic Carcinoma: Nine Cases (2007–2016). *Journal of the American Animal Hospital Association*. 2018 Sep;54(5):291–295.
- <sup>6</sup> Törner, K.; Aupperle-Lellbach, H.; Staudacher, A.; Staudacher, M.; Steiger, K. (2019): Primary Solid and Cystic Tumours of the Exocrine Pancreas in Cats. In: *Journal of comparative pathology* 169, S. 5–19. DOI: 10.1016/j.jcpa.2019.04.002.
- <sup>7</sup> Cony, Fernanda G.; Slaviero, Mônica; Santos, Igor R.; Cecco, Bianca S.; Bandinelli, Marcelo B.; Panziera, Welden *et al.* (2023): Pathological and immunohistochemical characterization of pancreatic carcinoma in cats. In: *Journal of comparative pathology* 201, S. 123–129. DOI: 10.1016/j.jcpa.2023.01.008.
- <sup>8</sup> Cridge, Harry; Kathrani, Aarti; Johnston, Andrea N. (2026): Disorders of the Liver, Exocrine Pancreas, and Gastrointestinal Tract in Dogs and Cats: Wiley, S.182
- <sup>9</sup> Chan, Taylor C.; Heacock, Elisa; Cournoyer, Ashleigh; Walsh, Koranda; Durham, Amy C. (2025): Hyalinizing pancreatic adenocarcinoma in a cat. In: *JFMS open reports* 11 (1), 20551169251325333.

- <sup>10</sup> Dennis, M. M.; O'Brien, T. D.; Wayne, T.; Kiupel, M.; Williams, M.; Powers, B. E. (2008): Hyalinizing pancreatic adenocarcinoma in six dogs. In: *Veterinary pathology* 45 (4), S. 475–483.
- <sup>11</sup> Aupperle-Lellbach, H.; Törner, K.; Staudacher, M.; Müller, E.; Steiger, K.; Klopffleisch, R. (2019): Characterization of 22 Canine Pancreatic Carcinomas and Review of Literature. In: *Journal of comparative pathology* 173, S. 71–82.
- <sup>12</sup> Hagelskamp, Abby; White, Amelia G.; Gallman, Jeremy; Starbird, Cierra; Neto, Rachel L. A. L. T. (2024): Pancreatitis, panniculitis, and polyarthritis syndrome in a dog with hyalinizing pancreatic adenocarcinoma. In: *Journal of veterinary diagnostic investigation: official publication of the American Association of Veterinary Laboratory Diagnosticians, Inc* 36 (6), S. 886–890.
- <sup>13</sup> Liszka, Lukasz; Zielinska-Pajak, Ewa; Pajak, Jacek; Gołka, Dariusz (2008): Colloid carcinoma of the pancreas: review of selected pathological and clinical aspects. In: *Pathology* 40 (7), S. 655–663. DOI: 10.1080/00313020802436444.
- <sup>14</sup> Hagiwara, K.; Michishita, M.; Yoshimura, H.; Ochiai, K.; Azakami, D.; Ishiwata, T.; Takahashi, K. (2017): Pancreatic Colloid Carcinoma in an Elderly Cat. In: *Journal of comparative pathology* 157 (4), S. 266–269.
- <sup>15</sup> Banner, B. F.; Alroy, J.; Kipnis, R. M. (1979): Acinar cell carcinoma of the pancreas in a cat. In: *Veterinary pathology* 16 (5), S. 543–547. DOI: 10.1177/030098587901600506.
- <sup>16</sup> Castellano-Megías, Víctor M.; Andrés, Carolina Ibarrola-de; López-Alonso, Guadalupe; Colina-Ruizdelgado, Francisco (2014): Pathological features and diagnosis of intraductal papillary mucinous neoplasm of the pancreas. In: *World journal of gastrointestinal oncology* 6 (9), S. 311–324.
- <sup>17</sup> WHO Classification of Tumours Editorial Board. Digestive System Tumours. 5th ed. Lyon: International Agency for Research on Cancer; 2019.