WEDNESDAY SLIDE CONFERENCE 2014-2015

Conference 24
06 May 2015
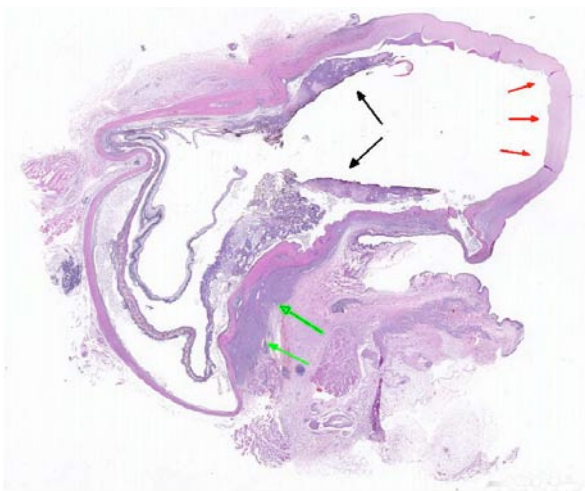

CASE I: SP-12-7847 (JPC 4031937).

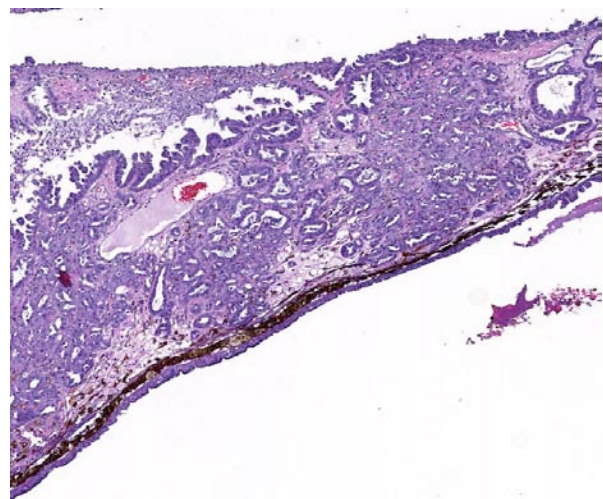**Signalment:** 15-year-old castrated male domestic medium hair cat, *Felis catus*.

History: This cat had a 4-week history of hyphema and corneal opacity of the right eye (OD). Physical examination revealed dyscoria, epiphora, conjunctival hyperemia, 2+ buphthalmos, 2+ aqueous flare, hemorrhage within the anterior chamber, corneal midstromal neovascularization and edema, and increased intraocular pressure (54 mmHg) OD. The eye was enucleated and submitted for microscopic examination.
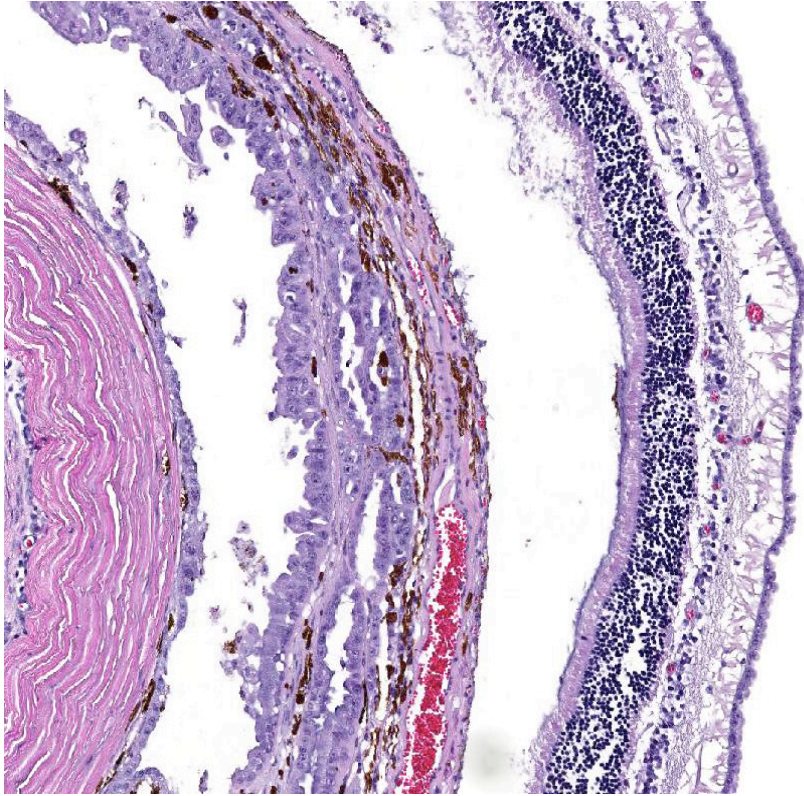
Laboratory Results: Three-view radiographs of the thorax revealed a soft tissue opacity in the left

1-1. Eye, cat: The specimen is collapsed from anterior to posterior. The cornea is at right (red arrows). An infiltrative neoplasm is present throughout the globe, markedly expanding the iris (black arrows), elevating the choroid and retina at the back of the globe, and extending through the sclera into the surrounding soft tissue (green arrows). (HE 3X)

1-2. Eye, cat: Closer view of the iris, which is expanded by an infiltrative epithelial neoplasm which forms variably sized tubules and acini, lined by papillary projections of neoplastic cells. Both the anterior and posterior aspects are lined by neoplastic cells. (HE 44X)

1-3. Eye, cat: The retina (right) is detached and the anterior surface is lined by neoplastic cells. The underlying choroid (center) is lifted off the connective tissue by a lining of neoplastic cells forming papillary and micropapillary projections. (HE 96X)

caudal lung lobe dorsally, the medial aspect of which appears to be associated with the left caudal lobar bronchus. Abdominal ultrasound did not reveal any abnormalities.

Histopathologic Description: The slides submitted to the conference contain the vertical section of a feline globe, which was collapsed as the result of a reported posterior rupture during enucleation. The globe is characterized by diffuse infiltration of the choroid and anterior uvea by a neoplastic population of epithelial cells causing extensive retinal detachment and complete occlusion of the filtration angles. The neoplastic cells are cuboidal to tall columnar and arranged in tubules, commonly containing either pale basophilic wispy material (mucin) or amorphous cell debris. Cells have indistinct cell borders and moderate to ample amount of eosinophilic cytoplasm, frequently with apical projections that stain basophilic with hematoxylin & eosin and magenta (i.e. positive) with the Periodic-Acid Schiff (PAS) reaction, consistent with mucus. The nuclei are round to oval and finely stippled with one or two prominent nucleoli. Anisocytosis and

anisokaryosis are moderate. Twelve mitoses are counted in ten high power fields. Neoplastic cells focally infiltrate the deep corneal stroma anterior to the Descemet's membrane and extensively colonize the posterior aspect of the Descemet's membrane, as well as the iris, ciliary body and inner retina. Additionally, aggregates of neoplastic cells extend through the sclera into the episcleral stroma, with evidence of vascular invasion and, in the dependent portion, focal scleral thinning (staphyloma) and prominent regionally extensive periscleral desmoplastic spindle cell proliferation. Moderate numbers of lymphocytes and plasma cells are multifocally present within the uveal tract amongst the neoplastic population. The detached retina exhibits diffuse atrophy of the nerve fiber and ganglion cell layer, as well as multifocal edema. There is mild cupping of the optic nerve head with mild gliosis (not present in all sections). Mild midstromal neovascularization is present in the peripheral cornea. The lens (not present in the submitted sections) exhibits extensive subcortical cataractous change, characterized by eosinophilic spherical globules (Morgagnian globules) and migration of the epithelium along the posterior lens capsule. Within sections of eyelid (not submitted), moderate numbers of lymphocytes and plasma cells infiltrate the subepithelial stroma. Blood vessels are moderately congested, accompanied by mild acute edema.
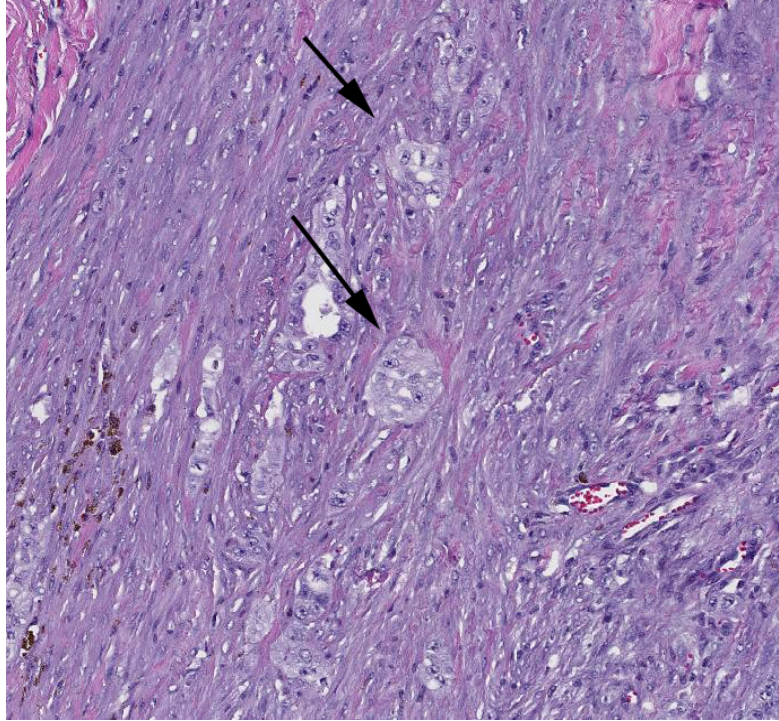
Contributor's Morphologic Diagnosis: Eye: Metastatic carcinoma, with secondary glaucoma, retinal detachment and atrophy, multifocal uveitis, and cataractous change.

Contributor's Comment: The pattern of neoplastic cell infiltration in this case is typical of intraocular metastatic carcinoma.[1,2] With the exception of multicentric lymphoma, carcinomas are the neoplasms most frequently reported to

metastasize to the globe in cats.[1] The majority of intraocular metastases involve the posterior uvea likely because of the rich blood supply to this tissue.[1,2] Ophthalmoscopic findings in cats with angioinvasive pulmonary carcinoma typically include wedge-shaped areas of chorioretinal degeneration most prominent in the tapetal fundus radiating away from the optic disc. Vascular attenuation with areas of lumen occlusion, serous exudation, and retinal hemorrhage in the peripapillary retina are also common. The pathogenesis of the ophthalmoscopic lesions is thought to be neoplastic embolization of branches of the short posterior ciliary arteries, which supply retinal and choroidal circulation.[1] Histopathological examination of affected globes shows neoplastic cells within ocular blood vessel lumens and widespread retinal and tapetal necrosis. Growth of the metastatic lesions along the vascular endothelium leads to segmental loss of perfusion and subsequent necrosis of the overlying retina and choroid.[1,2]

1-4. Eye, cat: Within the extraocular soft tissues, nests of neoplastic cells are surrounded by a prominent desmoplastic response. (HE 92X)

Carcinomas reported as metastasizing to the feline eye have been of pulmonary, sweat gland, mammary, uterine, and squamous cell origin.[1,2] In this case, the metastatic carcinoma in the eye was presumed to be of pulmonary origin based on the radiographic findings of a tissue opacity in the caudal lung, the most commonly affected lung field by primary lung tumors in cats.[4] CT scan and fine needle aspirate of this lung lesion with follow-up with the oncology team was recommended. The owners declined any further workup, however. The cat was euthanized three months later, at which point it was emaciated and unresponsive. No necropsy was performed.

Primary lung tumors are uncommon in cats, with older animals more commonly affected (mean age 12 years).[3,4] Lesions tend to be malignant and with a grave prognosis. When diagnosed early, with no evidence of metastatic disease, solitary lung tumors may be surgically resected. The degree of differentiation of the pulmonary neoplasm has been suggested to be a prognostic indicator, with cats with moderately differentiated primary lung tumors having reportedly a significantly longer survival time (median 698 days) than cats with poorly differentiated primary lung tumors (median 75 days).[5] However, early diagnosis is difficult since most cats initially present with nonspecific clinical signs or signs related to metastases.[3] Lameness, associated with metastasis to the bone and skin of the digits,[3] or visual deficits (associated with intraocular metastasis),[1] may be the only initial presenting sign. Intraocular metastasis may be underestimated since ophthalmoscopic and microscopic examinations are not performed on a routine basis in many cases. Other sites of metastasis of primary lung tumors in cats include skeletal muscle, and multiple thoracic and abdominal organs.[4] Thorough clinical examination and thoracic radiography can provide a high index of suspicion of the primary neoplasm.[4] Cytologic evaluation of cells obtained by fine-needle aspiration of the lung mass, as well as of cells collected from thoracic fluid or bronchoalveolar lavage can help determine the diagnosis.[3,4] Effective treatment has yet to be demonstrated for metastatic lung carcinomas in cats. As a result, most cats with metastatic lung

carcinoma die or are euthanized within 6 weeks of diagnosis.[5]

JPC Diagnosis: Eye: Metastatic carcinoma.

Conference Comment: This is an excellent descriptive slide with extensive ocular changes. Conference participants agreed the neoplasm is likely the result of metastasis from the pulmonary mass identified clinically. In the cat, lymphoma is by far the most prevalent metastatic tumor in the eye, although virtually any malignant neoplasm can localize within the uveal tract.[6]

Primary uveal neoplasms are common in dogs and cats and considerably more common than metastatic tumors, with the exception being metastatic uveal lymphoma in cats. Among primary ocular tumors, melanoma, lymphoma, posttraumatic sarcoma and iridociliary adenocarcinoma are most common in cats. Iridociliary adenocarcinoma is a reasonable differential in this case, but these typically benign neoplasms tend to infiltrate and expand the posterior chamber, often in solid sheets, in contrast to this case which filed along the uvea and choroid forming tubules.[6] Additionally, a PAS-positive basement membrane is highly conserved in these neoplasms and can aid in distinguishing from metastatic disease.[7] Extraocular metastasis from these primary tumors is rare or nonexistent; however, secondary complications are often significant, with glaucoma or intractable hyphema occurring most commonly.[6]

Of greater significance in cats are posttraumatic sarcomas, which are usually high-grade neoplasms of lens epithelial origin following lens rupture.[6] The majority of these are of the spindle cell variant and are often not recognized for years following a traumatic event. They are highly invasive within the globe though rarely metastasize. A round cell variant resembling lymphoma and osteo- or chondrosarcoma also occur following lens trauma, albeit at a much lower frequency.[2]

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CASE II: 08-65258 (JPC 3152323).

Signalment: 7-year-old castrated male DLH cat, *Felis catus.*

History: The cat was seen at the AUCVM Small Animal Teaching Hospital critical care service with a 1-2 day history of pancytopenia, dehydration, and dull mentation according to the referring veterinarian. The owners had not seen the cat drinking or using the litter box for the past few days. The cat was indoor-only, with no other feline or canine housemates. He did have access to a screened porch and was on Frontline but no heartworm preventative. Upon arrival at the AUCVM, the cat was quiet and dull with marked icterus of the sclera and oral mucous membranes. The animal's temperature was 105.2°, pulse rate 120 bpm, and respirations were 88 bpm. The mucous membranes were dry and had a capillary refill time of -3 seconds. Heart and lung sounds were normal.

Diagnostics: Diagnostic tests included CBC, chemistry panel, and thoracic and abdominal radiographs. Radiographic findings included a prominent interstitial lung pattern, Pertinent CBC and chemistry findings are given here.
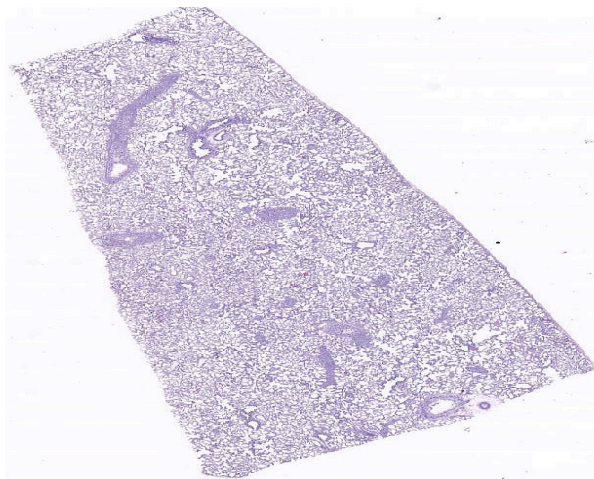
Parameter

HCT(%)	20.6	30-45
MCV (fl)	45.2	39-55
MCHC (g/dL)	33.1	30-36
RDW	18.3	11-17
Platelets (/uL)	28000	200,000-700,000
Reticulocyte Count (/uL)	3000	15,000-81,000
WBC (/uL)	2460	5,500-19,500
Neutrophils (/uL)	812	2,500-12,500
Bands (/uL)	1255	0-300
Total Protein (g/dL)	4.73	6.2-7.7
Albumin (g/dL)	2.0	2.8-4.2
Globulin (g/dL)	2.7	2.4-4.4
Total Bilirubin (mg/dL)	9.78	0. 1-0.2
Blood Urea Nitrogen (mg/dL)	50.1	5-30

Treatment and Case Outcome: Intravenous crystalloid fluids and broad-spectrum antibiotics were initiated on the night of 6/14/08, along with one unit of packed red blood cells. The next morning the cat was still dull and dysphoric and soon developed cardiac and respiratory arrest. Resuscitation efforts were unsuccessful. A necropsy was performed.
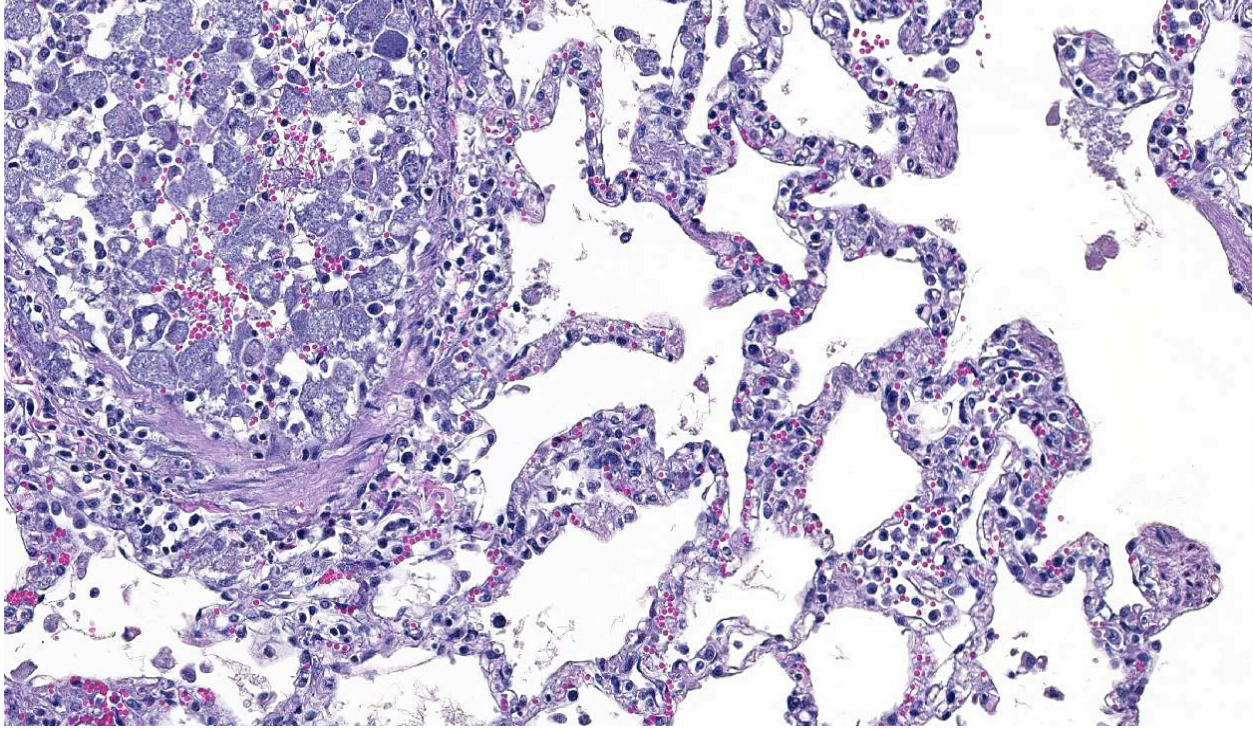
Gross Pathologic Findings: The cat was in good physical condition, but moderately overweight. All tissues were severely icteric. Multiple fleas were present. There was a significant amount of serosanguineous fluid in the trachea and large bronchi. The liver had a diffuse lobular pattern throughout the parenchyma. The edges of the liver lobes were rounded. There was a moderate amount of dark red to black fecal material in the large intestine. The spleen was markedly enlarged and bluish-black. The mesenteric lymph nodes were diffusely dark red.

Histopathologic Description: Blood vessels throughout the lung, liver, pancreas, adrenal glands, kidneys, and gastrointestinal tract are partially to almost completely occluded by few to numerous macrophages containing protozoal schizonts consistent with *Cytauxzoon felis*. Similar organisms are within macrophages filling subcapsular, cortical, and medullary sinuses of lymph nodes as well as within the splenic red pulp.

Contributor's Diagnosis: Parasitemia, diffuse, severe, whole body with intralesional schizonts

2-1. Lung, cat: At subgross examination, while pulmonary vasculature is prominent, blood is not evident within larger vessels. Pulmonary fields appear crowded due to expansion of alveolar septa. (HE 3X)

2-2. Lung, cat: Alveolar septa are expanded up to 3x normal by numerous macrophages, dilated capillaries, edema, and fibrin. The adjacent pulmonary venule is expanded and almost occluded by the present of numerous macrophages enlarged by schizonts of Cytauxzoon felis. (HE 104X)
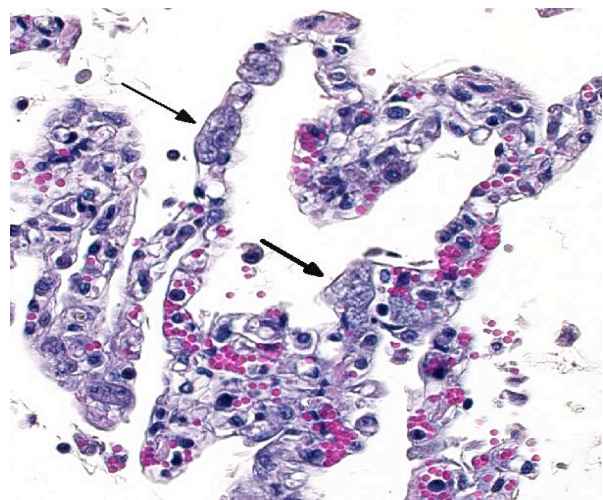
containing protozoal organisms consistent with *Cytauxzoon felis.*

Contributor's Comment: *Cytauxzoon felis* is a protozoal parasite that infects wild and domestic cats. It is transmitted by a tick vector *(Dermocenter variabilis).* Bobcats and possibly other wild felids are believed to serve as the reservoir host.[4] The organism exists in two tissue forms; a piroplasm erythrocyte stage and a schizont tissue phase found within macrophages primarily in the spleen, liver, and lung. Clinical findings include acute illness with fever, depression, anorexia, pallor, icterus, and usually death within a few days.[4] Some cats do survive natural infections.[2] Diagnostic findings often include pancytopenia with nonregenerative anemia. The urine in the early hemolytic phase is highly concentrated, acidic and contains large amounts of protein, bile and blood.[6]

Previously, antemortem diagnosis was made by identification of erythrocyte piroplasms, but PCR assays for this agent are now available. This more sensitive method of detection has lead to the identification of cats that either have subclinical infection or that have recovered from an infection and become chronic carriers.[2] Genetic variability

of *Cytauxzoon felis* has been proposed as a possible explanation for why some animals recover from infection or fail to develop clinical signs.[1]

JPC Diagnosis: 1. Lymph node: Lymphadenitis, histiocytic, diffuse, mild, with lymphoid depletion, hemorrhage, thrombosis, and numerous intravascular intrahistiocytic schizonts.

2-3. Lung, cat: Occasional alveolar capillaries contain Cytauxzoon schizonts. (HE 292X)

2. Lung: Pneumonia, interstitial, histiocytic, diffuse, mild, with numerous intravascular intrahistiocytic schizonts.

Conference Comment: Two different slides were distributed for this case, both exhibiting numerous intravascular apicomplexans typical of *Cytauxzoon felis*. *C. felis* spends its lifecycle in circulation following introduction through a tick vector. The schizonts within circulating macrophages demonstrated in this case are first cycle of schizogony, and in chronic disease, cytomeres are released and infect erythrocytes during the second cycle of schizogony to form the piroplasm ring (signet ring) often evident on cytology.[6]

The disease is uncommon, but often fatal in cats when it occurs.[4] The intrahistiocytic phase leads to systemic circulatory compromise due to partial or complete vascular obstruction.[4] The erythrocytic phase is characterized by persistent parasitemia with anemia which may exacerbate ischemic tissue damage. Ischemic damage can also cause cerebral necrosis, appearing similar in some respects to feline ischemic encephalopathy and thiamine deficiency.[3] Dyspnea is also a common clinical finding of infected cats, and interstitial pneumonia seems to be a consistent finding and may be the largest contributor to respiratory difficulty, possibly leading to acute respiratory distress syndrome in some cases.[5]

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CASE III: E 3476-12 (JPC 4048934).

Signalment: 11-year-old male Bobtail dog, *Canis familiaris*.

History: The dog was clinically presented with anorexia and weight loss. Ultrasonic examination revealed a thickening of the stomach wall. By laparotomy a mass of approximately 2.0 cm in diameter was excised from the pylorus.

Gross Pathology: One tissue sample measuring 2.2 x 1.4 x 1.2 cm was submitted for histologic examination.

Histopathologic Description: Stomach: Expanding the submucosa and elevating the overlying gastric mucosa there is a mostly well demarcated, but unencapsulated, densely cellular and partially infiltrative growing ovoid mass of up to 1.5 x 0.5 cm in dimension, which extends partially to the cut borders.

The cells are closely packed in sheets with a moderate amount of fibrovascular stroma. Single tumor cells are ovoid to polygonal, ranging in size from 20 to 30 µm in diameter. Cell borders are distinct. The moderate to abundant amount of eosinophilic cytoplasm is finely granular. Round to ovo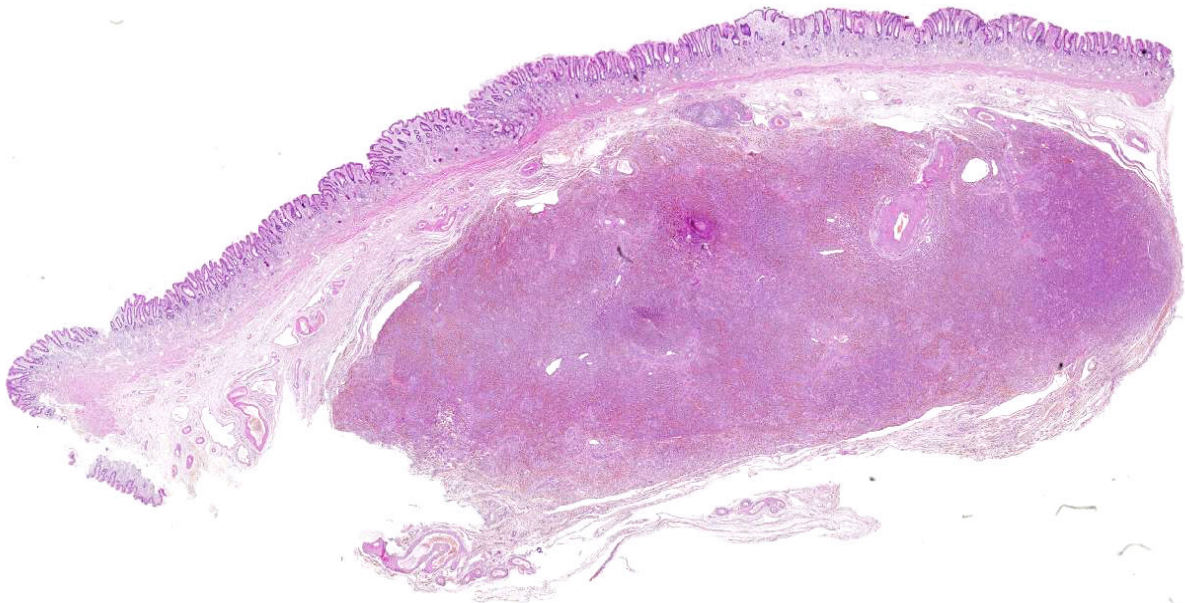id nuclei, ranging in size from 10 to 15 µm in diameter, are often located eccentrically within the cells. The chromatin is finely stippled, in some nuclei finely clumped with a distinct round centrally located eosinophilic nucleolus in each nucleus. Bi- and multinucleated tumor cells with up to three nuclei are frequent (> 5 / HPF). Anisocytosis and anisokaryosis are striking. The mitotic rate is low with up to 1 mitotic figure per high power field.

Preexisting vessels within the mass are thickened by increased numbers of spindle cells in the media (media hyperplasia) and deposition of extracellular, eosinophilic, fibrillar material (collagen).
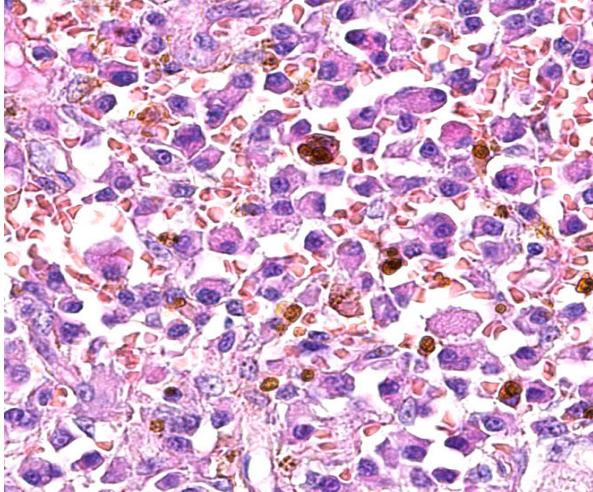
Additionally, throughout the mass multifocal acute hemorrhages with extravasation of erythrocytes and fibrin, depositions of granular golden-brown pigment (hemosiderin) in macrophages and multiple areas of necrosis are present.

Submucosal tissue surrounding the neoplasm is expanded by edema, occasional hemorrhages, multiple hemosiderin-laden macrophages and moderate numbers of plasma cells.
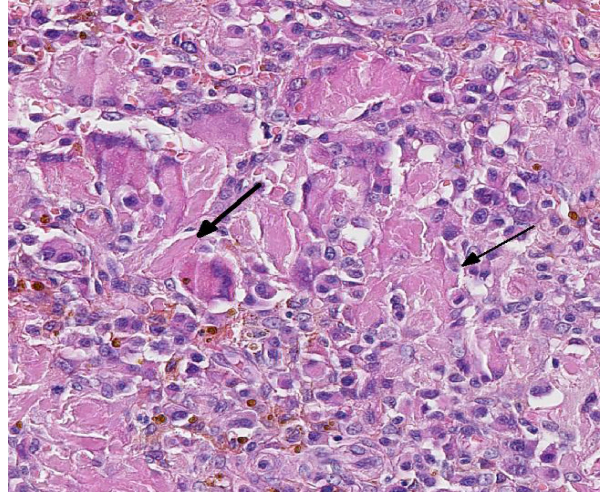
Contributor's Morphologic Diagnosis: Stomach: Extramedullary plasmacytoma.
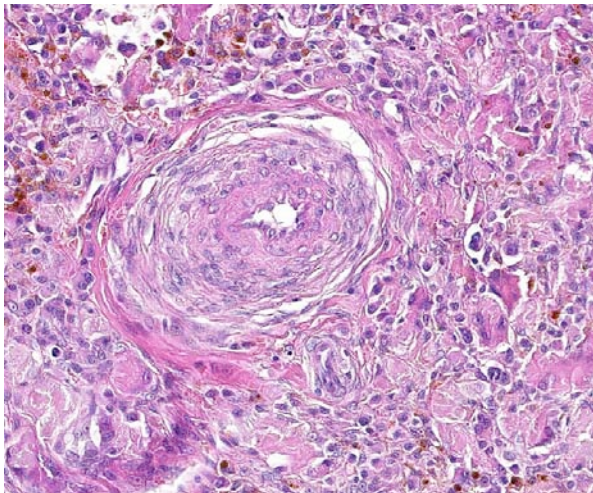

3-1. Stomach, dog: Within the pyloric submucosa, there is an expansile, well-demarcated, densely cellular neoplasm. (HE 3X)

3-2. Stomach, dog: The neoplasm is composed of uninucleated and multinucleate plasma cells. Numerous hemosiderin-laden macrophages are scattered throughout the neoplasm. (HE 300X)

3-3. Stomach, dog: Multifocally, neoplastic plasma cells are separated by homogenous to fibrillar eosinophilic material (presumed amyloid) which is occasionally engulfed by multinucleated foreign-body type macrophages. (HE 300X)

3-4. Stomach, dog: Within the neoplasm there is marked hypertrophy of arteriolar walls. (HE 144X)

Contributor's Comment: In veterinary medicine three forms of plasma cell tumors are distinguished. Multiple myeloma (MM) which arises in the bone marrow, cutaneous plasmacytomas and extramedullary plasmacytomas (EMP) which arise from sites other than the bone marrow. The synthesis of large amounts of monoclonal immunoglobulins, resulting most often in a monoclonal gammopathy, is a similarity of all plasma cell neoplasms.[4,5] The first report of a gastric plasmacytoma in a human patient was published in 1928 by Vasiliu and Popa and 1984 MacEwen and colleagues documented the first veterinary cases in two dogs.[6,15] Since then only few reports of intestinal extramedullary plasmacytomas in dogs, cats or horses exist.[3-7,13]

Clinically, gastric plasmacytomas appear nonspecific; occasionally epigastric pain, vomiting, anorexia weight loss and hemorrhages occur. Specific gross lesions are rare, as tumors cause more or less diffuse thickening of the stomach wall, like other round cell tumors. Histologically, gastric plasmacytomas are unencapsulated, but well demarcated, densely cellular masses, composed of variable mature, well- to poorly-differentiated round cells, which often contain typically eccentric located nuclei. Bi- and multinucleated cells with up to 5 nuclei per cell are a frequent finding.[5,8]

The deposition of AL-amyloid within tumor masses has been reported in few cases of EMP.[9,10,12] Congo red stain is useful to distinguish a gastric plasmacytoma from other round cell tumors, like malignant lymphoma or histiocytoma.[2,5] Congo red stain in this case failed to identify amyloid deposits.

The development of MM proceeding from EMP has not been determined in dogs, in contrast to humans.[8,13] In general, EMP located in the oral cavity tend to be benign, whereas EMP of the aboral digestive tract (esophagus, stomach, intestine, and rectum) tend to be more aggressive with potential to metastasize via the regional lymph nodes.[5]

JPC Diagnosis: Stomach: Extramedullary plasmacytoma.

Conference Comment: Extramedullary plasmacytomas are relatively common in older dogs, accounting for 2.4% of all canine tumors in a recent publication.[11] While they most often occur in the skin and mucus membranes, tumors of the abdominal viscera do occur, albeit with much less frequency.[11] Cutaneous and oral plasmacytomas are generally benign with no related clinical signs, and other references describe gastrointestinal plasmacytomas as more likely to be malignant.[1,14]

Conference participants agreed with the contributor's assessment that the preexisting vessels in the submucosa are moderately thickened, though it was suspected amyloid is also responsible for this expansion in addition to spindle cells. There is abundant hemosiderin within this neoplasm, often within apparent neoplastic plasma cells. Iron accumulation in neoplastic plasma cells is a feature identified in previously reported cases, with one author speculating it may be due to a mutation of heme-containing enzymes.[11]

Plasmacytomas, in addition to multiple myeloma, lymphoma and ehrlichiosis, have all been associated with a monoclonal gammopathy.[1] Bence-Jones proteinuria is another clinical feature associated with plasma cell tumors; which are light chains of immunoglobulins small enough to permit their passage through the glomerulus.[1] A noted cytologic feature of plasma cell tumors is a rim of red globular material around the neoplastic cells, termed "flame figures", which is another supportive diagnostic finding to these neoplasms.

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http://www.vetmed.fu-berlin.de/en/einrichtungen/institute/we12/index.html

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CASE IV: 149705 (JPC 4049500).

Signalment: 2.5-year-old female Bernese mountain dog, *Canis familiaris*.

History: A 2.5-year-old female Bernese mountain dog was referred to the Veterinary School of Nantes for a 3-month history of vomiting, weight loss, dysorexia and apathy. Physical examination revealed a marked amyotrophy and pale mucous membranes.

Gross Pathology: At necropsy, the dog had a poor condition score with pale and subicteric mucous membranes. Kidneys were diffusely pale, white-to-tan, with a marked generalized granular capsular surface. The cortex had numerous red-to-tan dots and had spongious aspect after formaldehyde fixation.

Other lesions included slight petechial hemorrhages of the stomach mucosa (confirmed by histology and associated with a laminar marked endothelial mineralization and necrosis on Alizarin red stain). Spleen was mildly firm, increased in size, and liver slightly and diffusely dark (HE and Perls stained slides: splenic and hepatic hemosiderosis and splenic macrophagous hyperplasia and extramedullary hematopoeïsis). 10 mL of serous pericardial effusion was found.

Laboratory Results: Clinical laboratory data oriented on chronic renal insufficiency with significant proteinuria suggesting a glomerular involvement. (BUN 38 md/dL; Creatinine 3.9 mg/dL; Albuminemia 2.0 g/dL; Proteinemia 3.9 g/dL; Proteinuria 0.48 g/dL; RPCU 8.6; Du=1.018). Blood count revealed a severe anemia, mildly regenerative, macrocytic with polychromasia, acanthocytes and schistocytes, compatible with an intravascular hemolytic process.
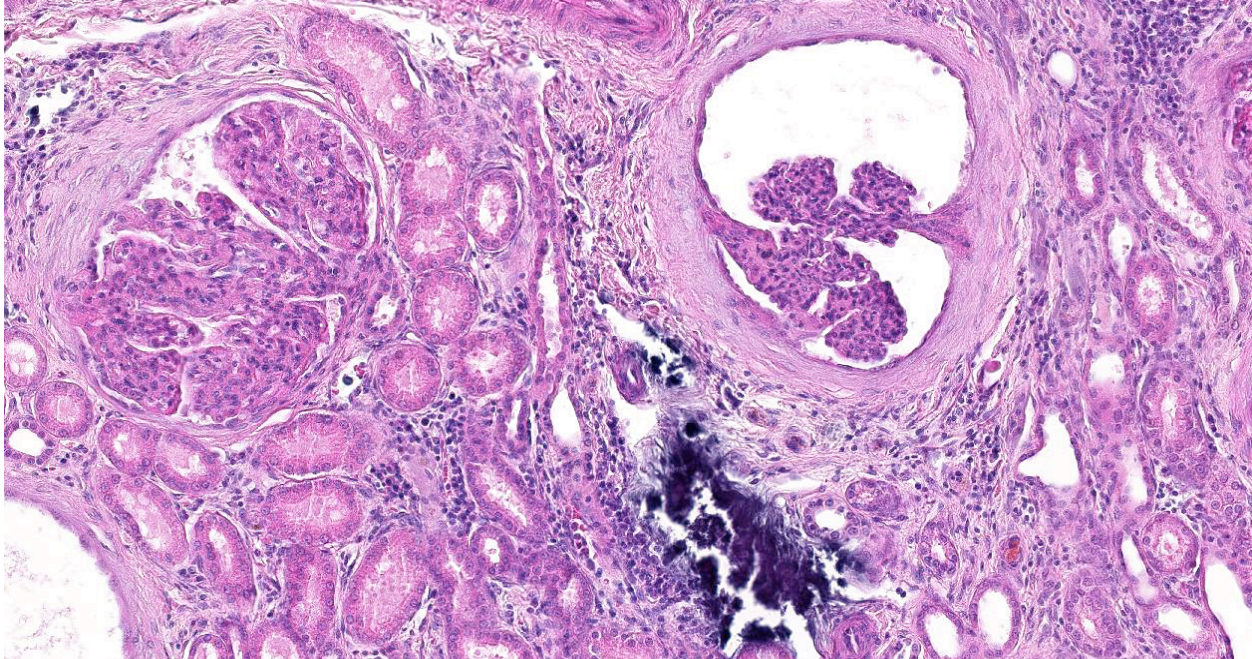
Histopathologic Description: Diffusely, glomerular tufts are enlarged with severe dilation of urinary chambers, increased tufts lobulation, thickening of the glomerular basement membrane, fibrotic changes including synechiae, capsular fibrosis and obsolescent glomeruli. Multifocally, hypertrophy and hyperplasia of parietal epithelial cells and periglomerular proliferation of myoepithelial arterioles were observed. Multifocally, within tubules, there is homogenous eosinophilic material (proteinuria), rare erythrocytes (hematuria), and rare intratubular karyorrhectic debris. A greyish material deposit was observed on tubular basement membrane and tubular epithelium (calcification). Interstitial lesions include aggregates of plasma cells, lymphocytes and fibrosis.

PAS staining: glomerular hypercellularity with both mesangial and endocapillary proliferation. Glomerular basement membranes are thickened.

Gomori Staining: multifocally, there are red dots in podocyte cytoplasm and basement membrane,

4-1. Kidney, dog: Subgross examination of the section of kidney reveals cystic dilation of Bowman's capsules, and linear areas of fibrosis with a prominent cellular infiltrate. (HE 4X)

4-2. Kidney, dog: The glomerular tuft at left is enlarged with marked segmentation, hypercellularity, synechiation, and periglomerular fibrosis. Tubules are separated by moderate amounts of collagen which contains moderate numbers of lymphocytes and plasma cells and large aggregates of crystalline mineral. (HE 120X)

Breed	*Glomerulopathy*
Beagle	Amyloidosis Membranoproliferative glomerulonephritis
Bernese mountain dog	Membranoproliferative glomerulonephritis
Bull terrier	Hereditary nephritis
Bullmastiff	Focal and segmental glomerulosclerosis
English cocker spaniel	Hereditary nephritis
Dalmatian	Hereditary nephritis
Doberman pinscher	Glomerulosclerosis Cystic glomerular atrophy
English foxhound	Amyloidosis
French mastiff	Juvenile glomerulopathy
Greyhound	Glomerular vasculopathy and necrosis
Newfoundland	Glomerulosclerosis
Pemprobe Welsh corgi	Cystic glomerular atrophy
Rottweiler	Atrophic glomerulopathy
Samoyed	Hereditary nephritis
Shar-Pei	Amyloidosis
Soft-coated wheaten terrier	Proliferative and sclerosing glomerulonephritis

and there are fibrotic glomerular and interstitial changes.

Contributor's Morphologic Diagnosis:
Kidney: Glomerulonephritis, membranoproliferative, diffuse, marked, chronic, with proteinuria, glomerular microcysts and fibrotic changes.
Kidney: Interstitial nephritis, lymphoplasmocytic and fibrotic, mild, multifocal, chronic.

Contributor's Comment: Glomerular disease is major cause of chronic kidney disease in dogs. It results from alteration of the glomerular filtration barrier, which includes fenestrated endothelial cells, glomerular basement membrane, epithelial slit pores formed by podocytic processes.[3]

Defects in the glomerular selective filtration result in proteinuria and renal insufficiency, whose clinical spectra ranges from asymptomatic or proteinuric dogs, to non specific presentation (weight loss, apathy, anorexia), or evident signs of chronic renal insufficiency (polyuria, polydipsia, vomiting, halitosis).[6] Extrarenal complications of glomerular diseases include: nephrotic syndrome (hypoalbuminemia, proteinuria, hypercholesterolemia, edema, serous effusions); thromboembolism, secondary to loss of

antithrombin III; hypertensive illnesses; and microangiopathic anemia.[2,6]

Glomerular diseases can be acquired or congenital. Acquired glomerular injuries can result from:

1) Immune complex deposition (glomerulonephritis proliferative, membranous, membranoproliferative). Etiologies range from chronic infections (canine pyometra, *Borrelia burgdoferi*, etc.) to immune-mediated diseases (systemic erythematous lupus).[3]

2) In situ immune complex formation (anti-GBM glomerulonephritis). Antibodies bind on GBM antigens. It is rare in domestic animals, and suspected in several dogs. In humans, antibodies cross-reaction occurs by antigenic mimicry between streptococcus and GBM for instance.[3,6]

3) Damage by systemic factors affecting the glomeruli. It includes mesangial deposits like amyloidosis, focal segmental glomerulosclerosis, and minimal change disease.[6]

Congenital glomerulopathy gathers an increasing number of breeds, whose pathogeny and mode of inheritance often remains unknown and varies a lot between breeds. The table lists dog breeds with reported familial glomerulopathies.[3]

In Bernese mountain dogs, a familial glomerulopathy was reported by Minkus and collaborators in 1994. Lesions included membranoproliferative glomerulonephritis, with concomitant interstitial nephritis and high titer of IgG against *Borrelia burgdorferi*.[4] Since then, few reports were published, but one of them highlights an absence of correlation between proteinuria, the early sign of glomerular lesions, and the antibodies against *B.burgdoferi*.[1]

The present case deals with a 2.5-year-old Bernese mountain dog with chronic renal insufficiency and histologic lesions compatible with membranoproliferative glomerulonephritis and interstitial nephritis; however, immunofluorescence should have been performed to confirm it. A proliferation of myoepithelial periglomerular arterioles was also suspected and supports a probable hypertensive state that has not been clinically evaluated.

JPC Diagnosis: Kidney: Glomerulonephritis, membranoproliferative, diffuse, marked, chronic, with glomerulosclerosis, fibrosis, tubular mineralization, and mild lymphoplasmacytic nephritis.

Conference Comment: The contributor has provided an excellent and concise overview of glomerular disease as well as its specific manifestation in the Bernese mountain dog. Glomerulonephritis is most commonly caused by immune-mediated mechanisms and occurs in three distinct patterns. Proliferative glomerulonephritis is characterized by increased cellularity and is the most common variant observed in horses, usually due to equine infectious anemia or streptococcal antigen. In membranous glomerulonephritis, thickened basement membranes are the predominant change which most commonly occurs in cats. This case is representative of the membranoproliferative form of glomerular disease as most commonly observed in dogs.[5] Collectively, these conditions are generally acquired from accumulations of immune complexes due to low pathogenicity chronic infections with persistent antigenemia.[3] The contributor also highlights those recognized familial forms of glomerular disease in dogs which usually arise in younger animals as a result of various mutations affecting collagen formation or other unidentified mechanisms.[3,4]

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