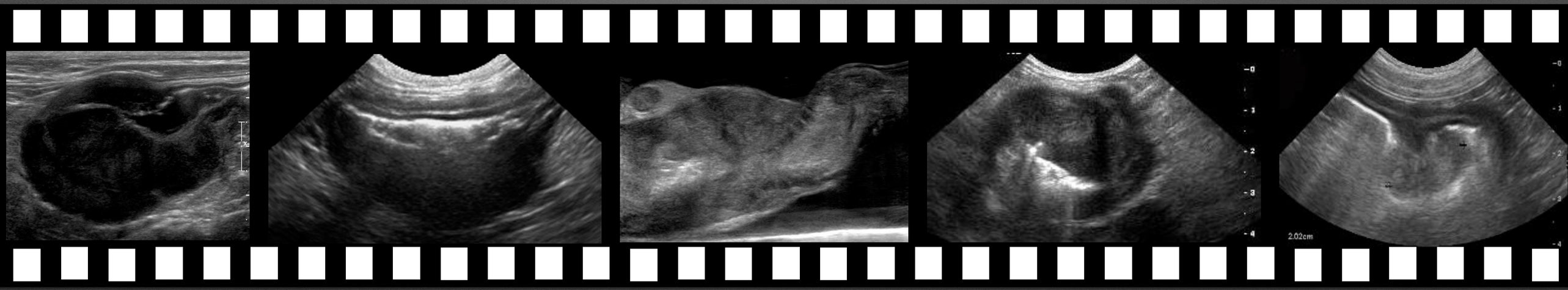
GI Nodules and Masses

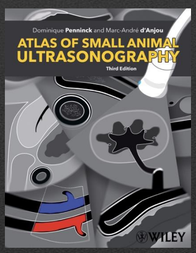
Part 1



Dominique Penninck, DVM, PhD, DACVR, DECVDI

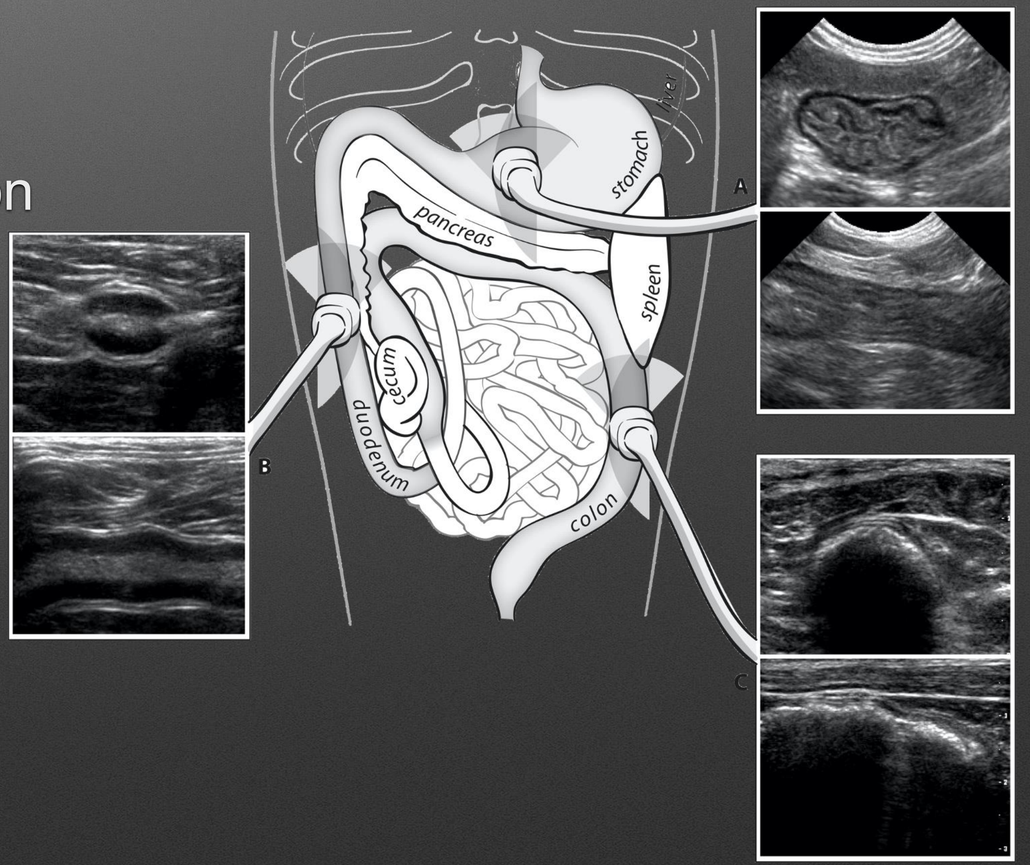
Professor, Diagnostic Imaging, Tufts University

SmallAnimalUltrasonography.com & Atlas of Small animal ultrasonography

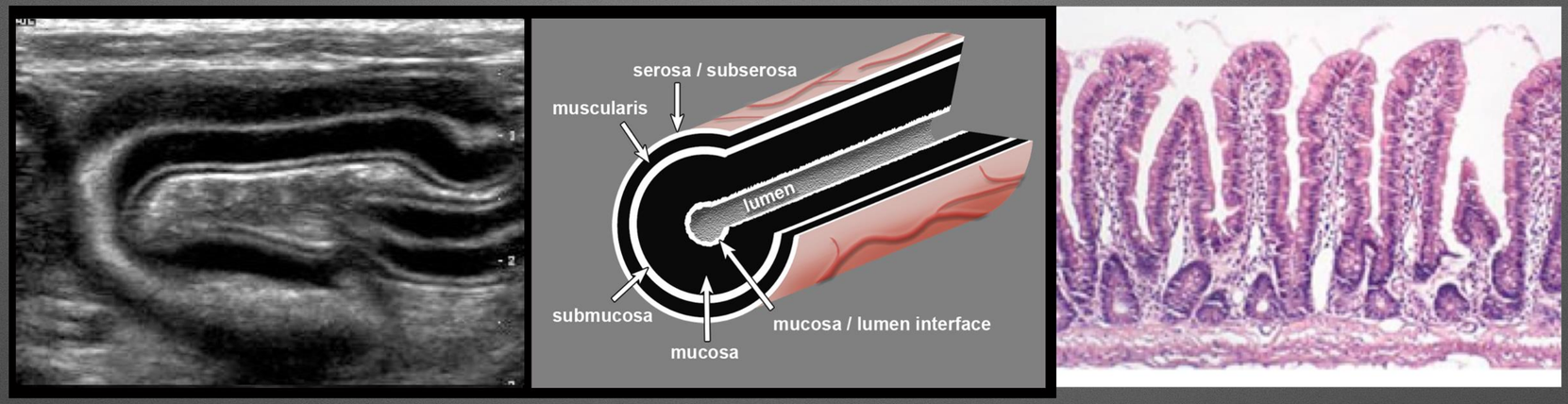


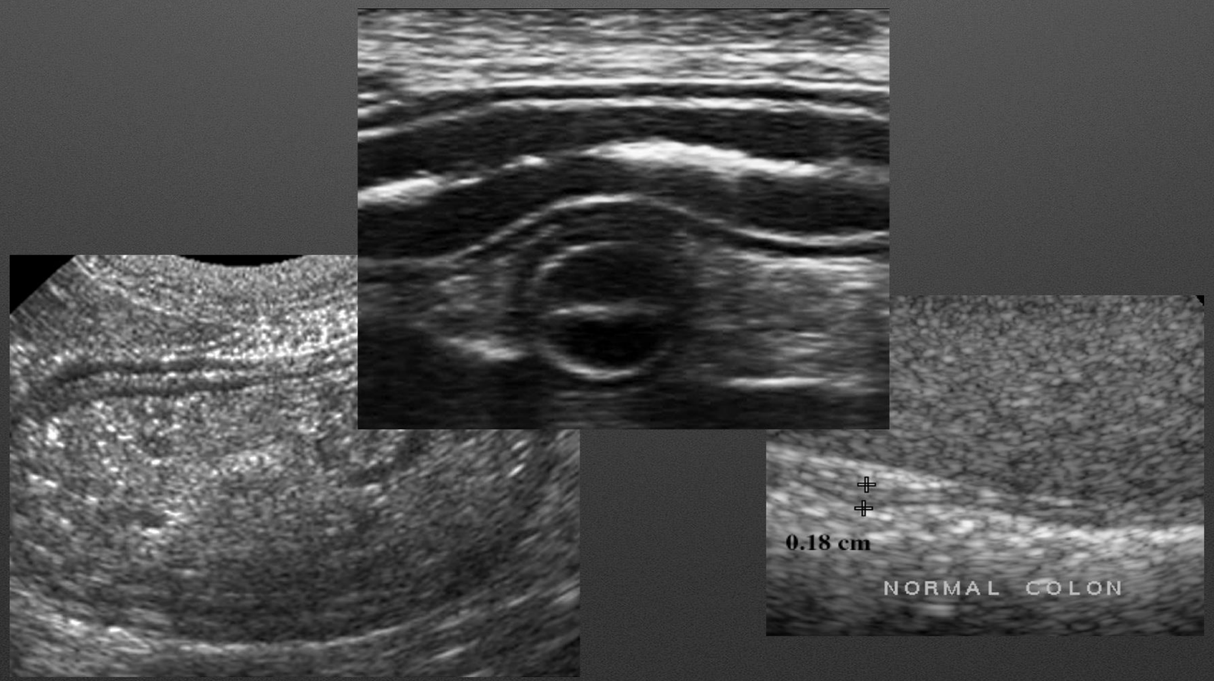
Morphologic Approach

- Location: fundus/body/antrum/pyloro-duodenal junction/intestines/ICJ/colon
- Distribution: focal, segmental, multi-segmental
- Thickness, echogenicity and layering distribution
- Obstructive or not
- Lymph node? Other organs?



Thickness & Layering

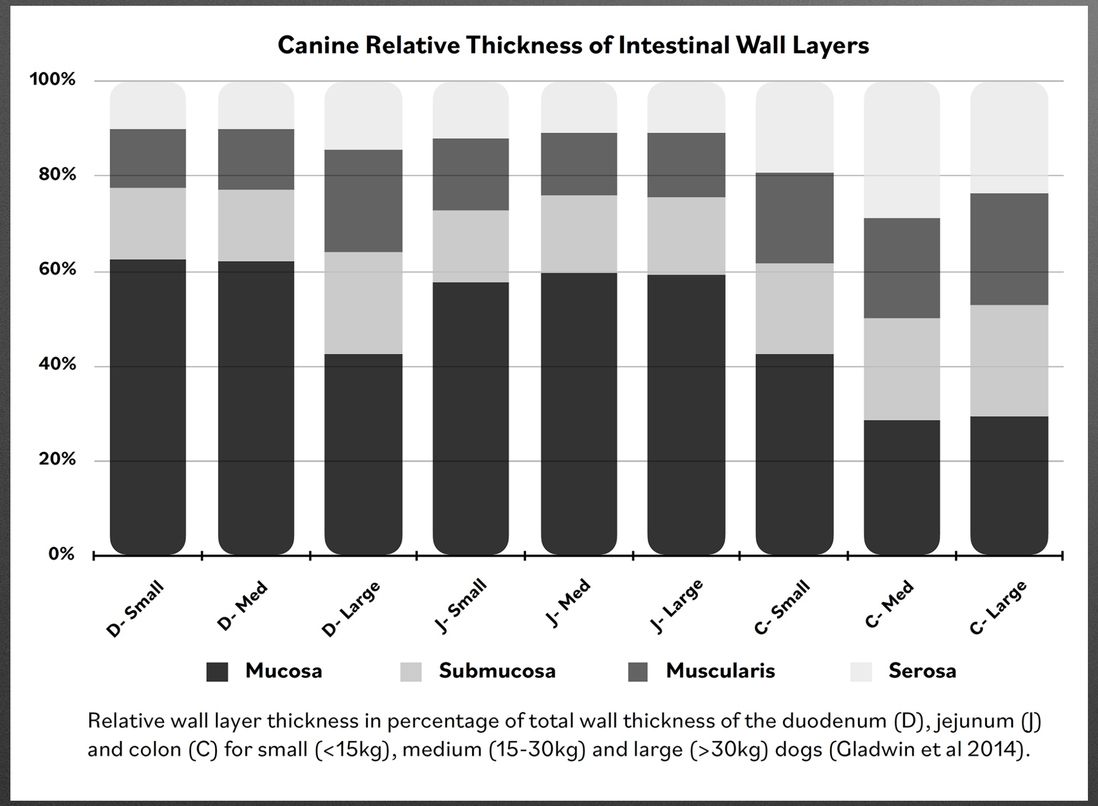




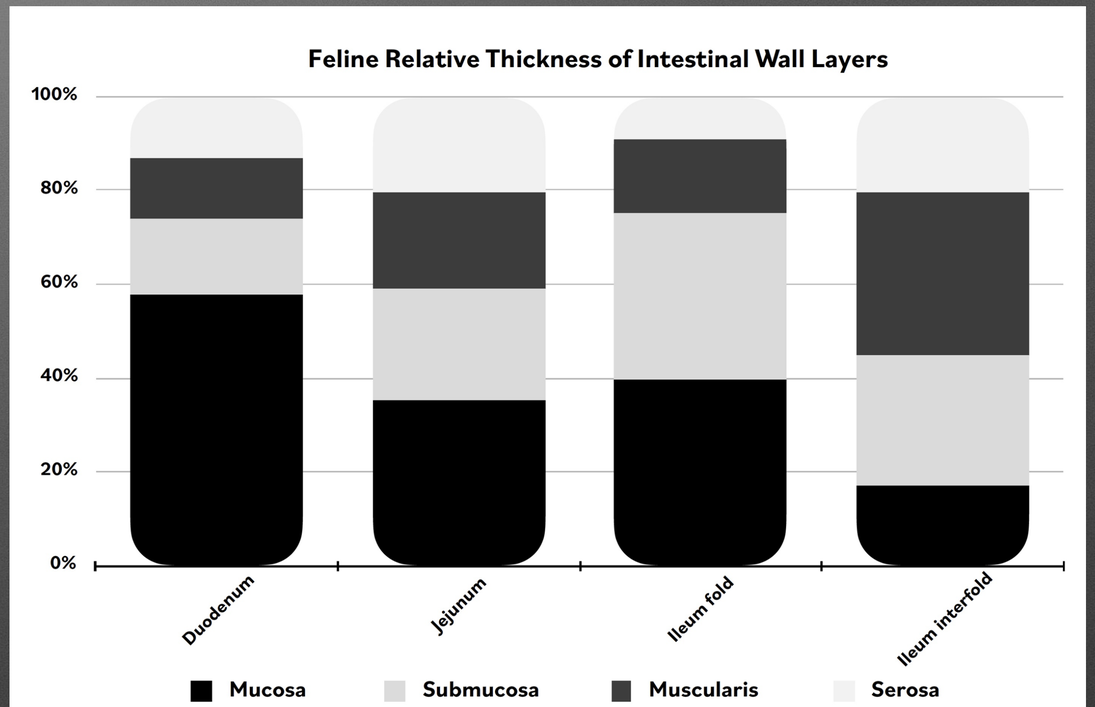
Mean measurements

DOG	Stomach	Duod	Jejunum	Ileum	Cecum	Colon
<15 kg	2-5 mm	3.8	3.0	3.0	as colon	Up to 1.5
15-30kg	2-5 mm	4.1	3.5	3.5	as colon	Up to 1.5
>30 kg	2-5 mm	4.4	3.8	3.8	as colon	Up to 1.5
CAT	2-4 mm	2.2	2.2	2.8	2-3	Up to 1.5

Wall layers

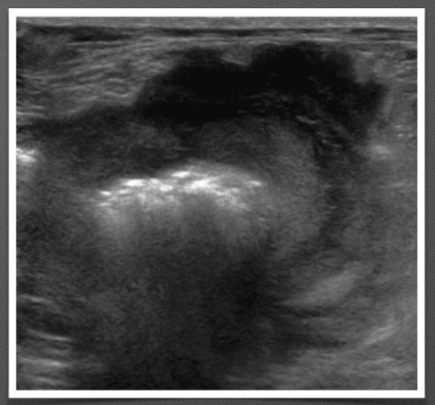


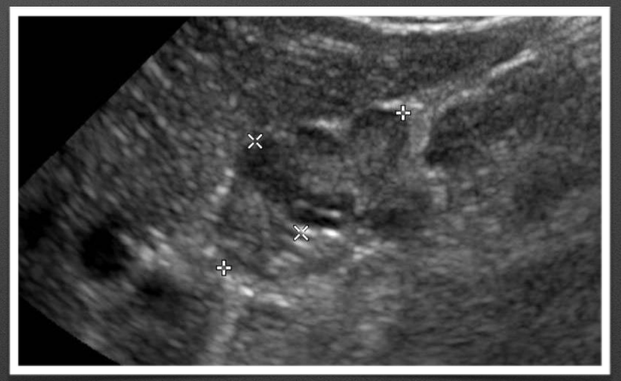
Relative wall layer thickness in percentage of total wall thickness of the duodenum (D), jejunum (J) and colon (C) for small (<15kg), medium (15-30kg) and large (>30kg) dogs (Gladwin et al 2014).



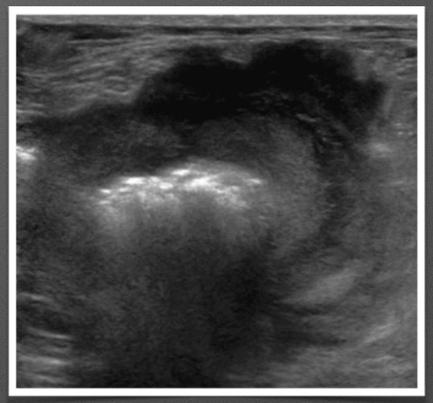
Relative wall layer thickness in percentage of total wall thickness of the duodenum (D), jejunum (J), and ileum measured at the fold and interfold locations for cats (Di Donato et al 2014).

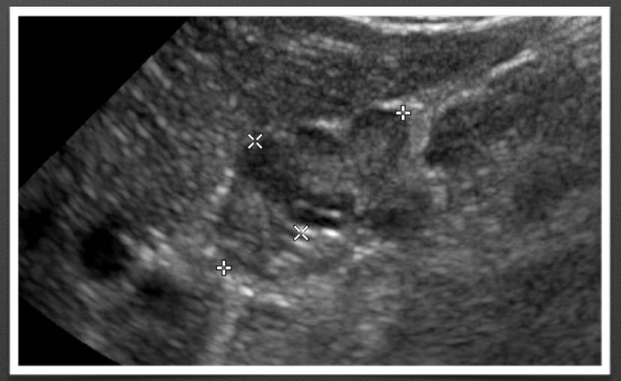
12-year-old cat with hyporexia and vomiting





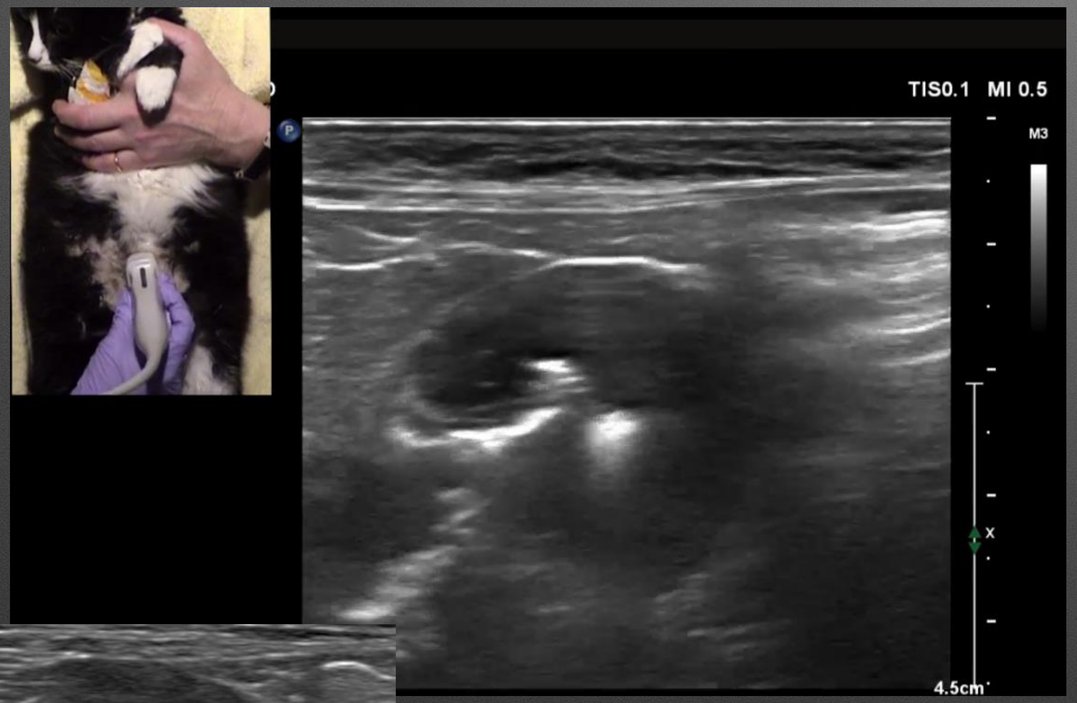
12-year-old cat with hyporexia and vomiting

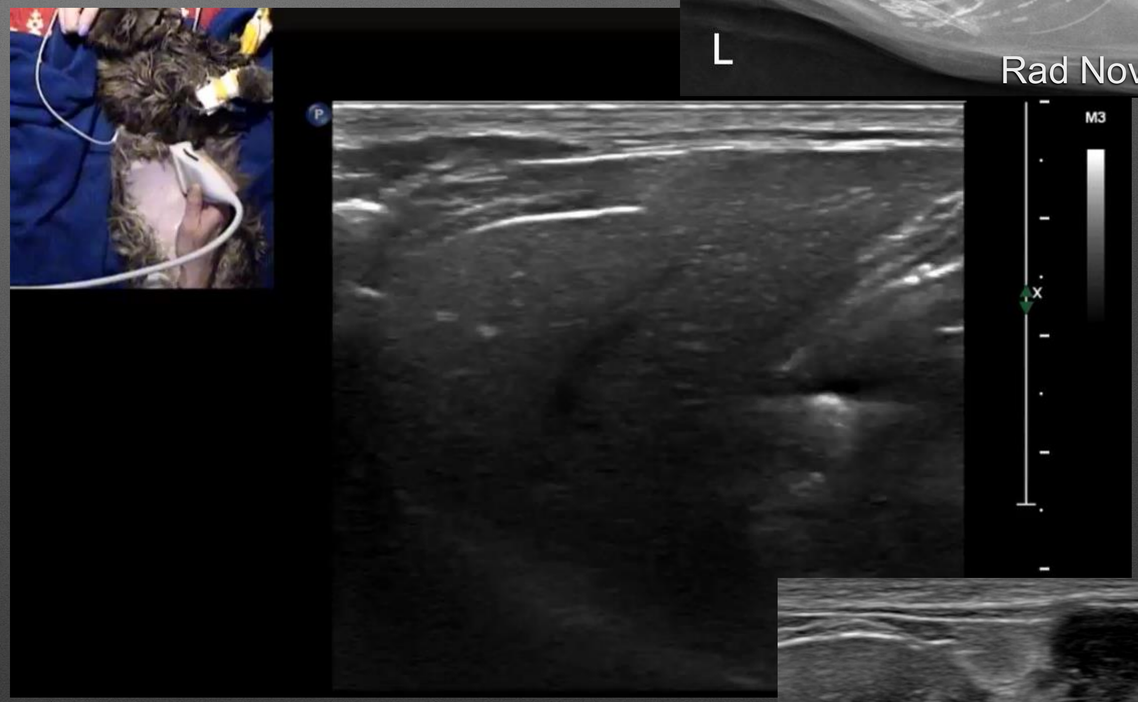




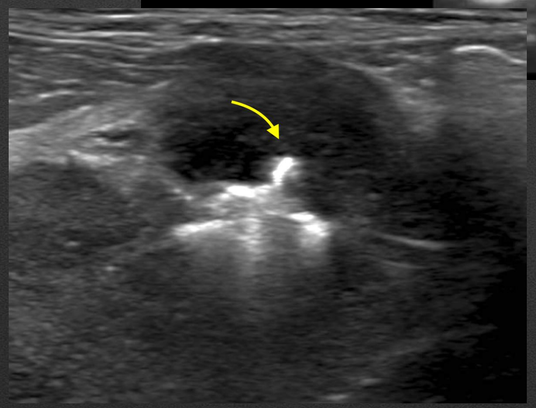
FNAs confirmed gastric lymphoma

Other findings…





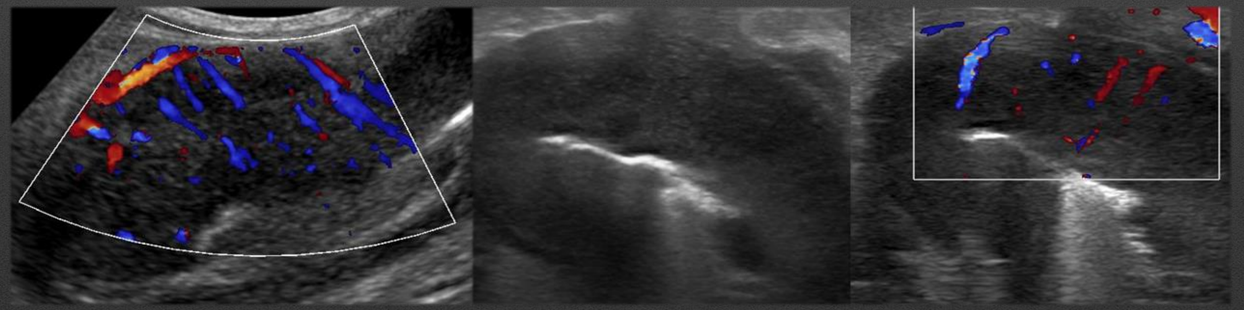
February study



B-mode ultrasound and colour Doppler findings in cats with gastric lymphoma

Quinci M, Pey P, Diana A, De Jesus A, Penninck D

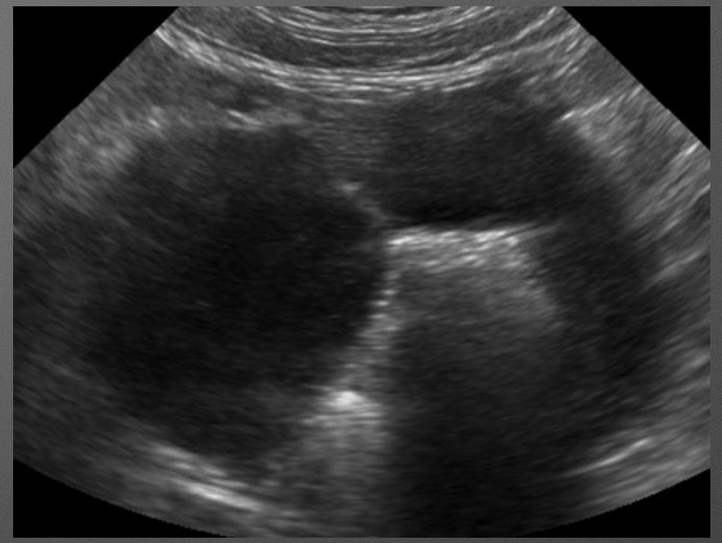
The most common US appearance of gastric lymphoma was **transmural hypoechoic segmental** wall thickening with **layering loss**. Location and distribution were variable. Colour Doppler displayed increased blood supply with a predominant pattern of perpendicular vessels, possibly representing aberrant arteries originating from subserosal and submucosal plexus. Lymphomatous infiltration of lymph nodes and other abdominal organs was frequent, confirming local and distant aggressiveness of gastric lymphoma in cats. Vomiting and haematemesis were frequently associated with the suspicion of ulcer on US. Perforation was a rare occurrence.

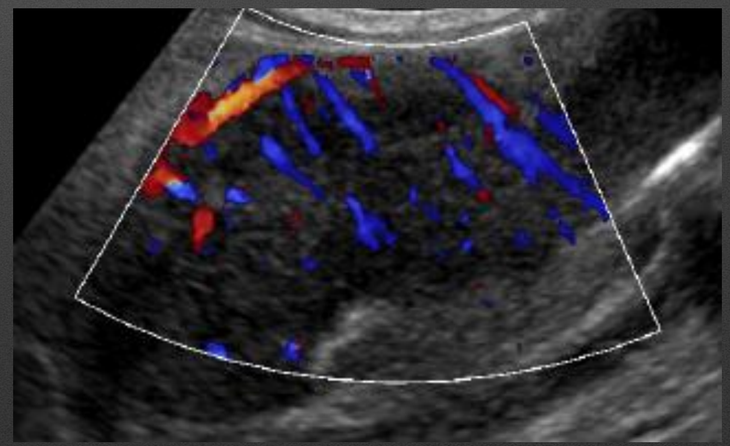


JFMS-2023

Main findings (45 cats)

- ✓ 71% transmural thickening
- ✓ 93% absent layering
- ✓ 85 % hypoechoic
- ✓ 2.1 cm mean maximum thickness
- ✓ 51% ulcers
- ✓ 97.7% lymphadenopathy
- ✓ 53% suspicion multicentric
- ✓ 24 % effusion

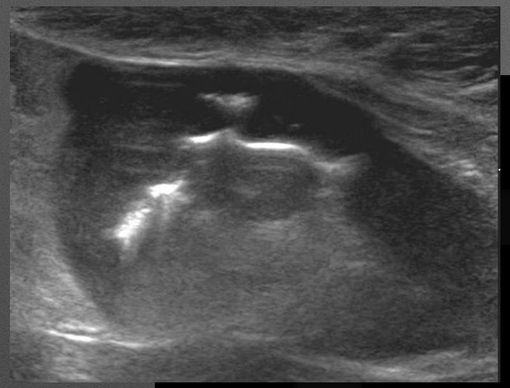


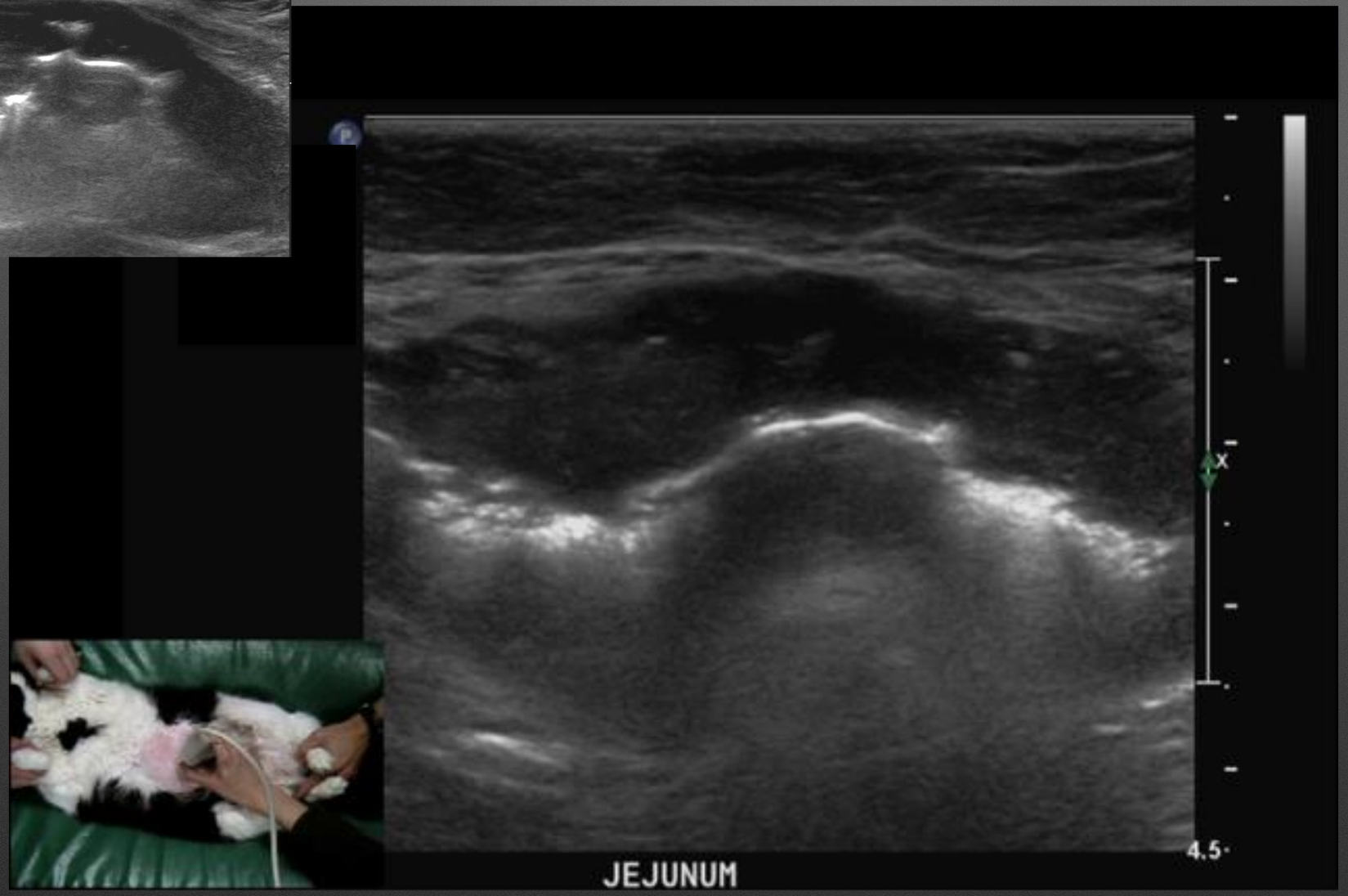


JFMS-2023

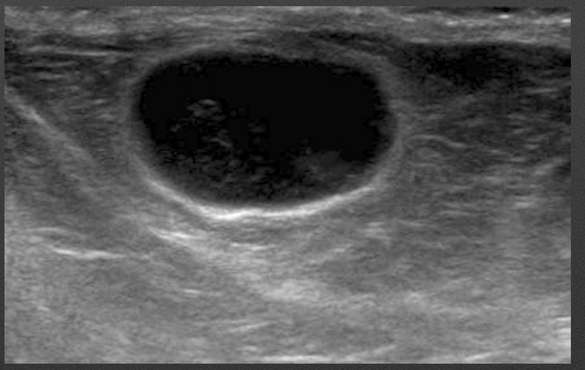
13-year-old cat presented for anorexia and weight loss. An abdominal mass was palpated.

Jejunal Location





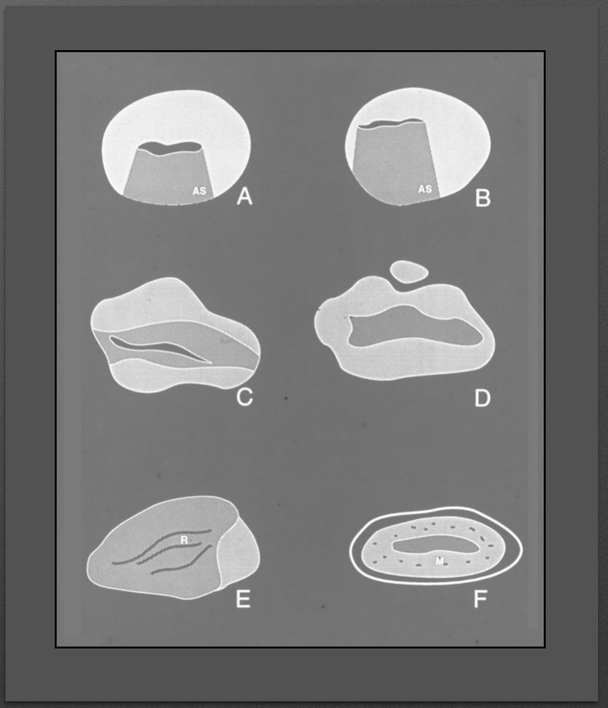
Jejunal LN



Inguinal LN

US Features of Lymphoma

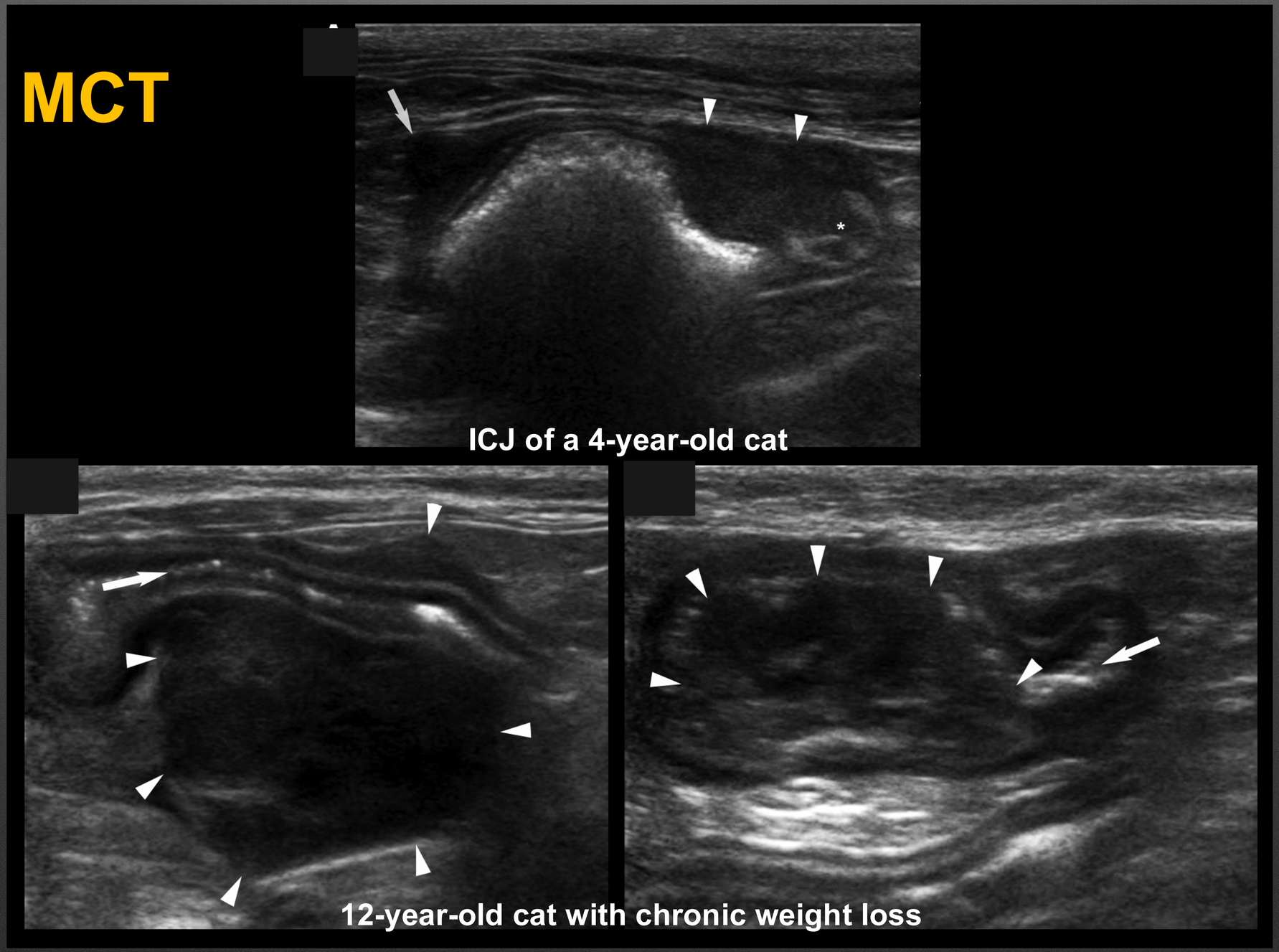
- segmental thickening/mass
- Loss of layering, poorly echogenic
- Often circumferential
- Often regional lymphadenopathy
- Rarely obstructive



Vladimir is a 12-year-old cat presented with decreased appetite and weight loss

Mast cell tumor

Feline MCT



ICJ of a 4-year-old cat

12-year-old cat with chronic weight loss

Mast Cell Tumor

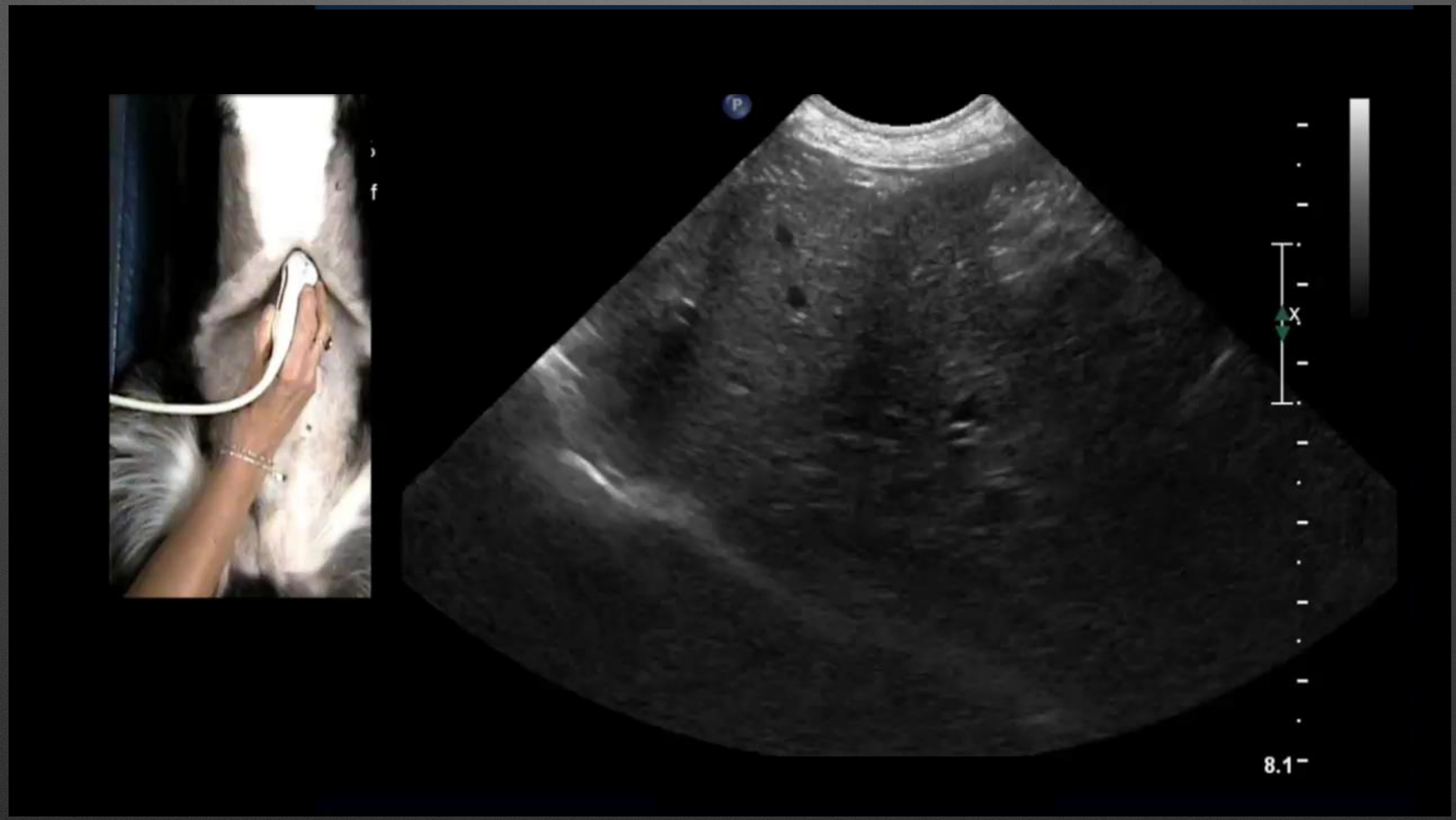
ULTRASONOGRAPHY OF INTESTINAL MAST CELL TUMORS IN THE CAT

MICHELE P. LAURENSON, KATHERINE A. SKORUPSKI, PETER F. MOORE, ALLISON L. ZWINGENBERGER

The sonographic features of intestinal mast cell tumors (MCT) were reviewed in **14 cats**. The mean age was 13.4 - 2.5 years. There were 16 focal intestinal tumors and one diffuse submucosal infiltrate. The most common pattern was **focal, hypoechoic wall thickening that was non-circumferential and eccentric (9/16 tumors) or circumferential, asymmetric, and eccentric (5/16 tumors)**. Nine of the cats had lesions in the jejunum or duodenum, four were at the ileocecocolic junction, and one cat had a colonic mass. **Six MCTs had altered but not loss of wall layering**, and the most commonly affected layer on ultrasound examination was the muscularis propria. **Nine cats had enlarged abdominal lymph nodes, and seven were due to metastatic disease.** Metastatic disease was not routinely detected by ultrasound in the liver (1/4 cats) or the spleen (0/3 cats). Concurrent small cell (T cell) lymphoma was present in four of 14 cats (29%).

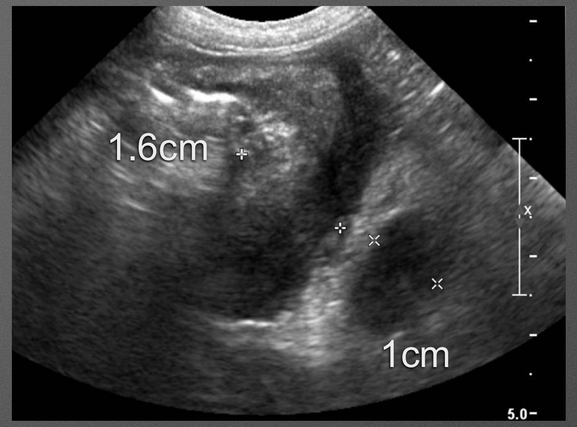
2011 Veterinary Radiology & Ultrasound, Vol. 52, No. 3

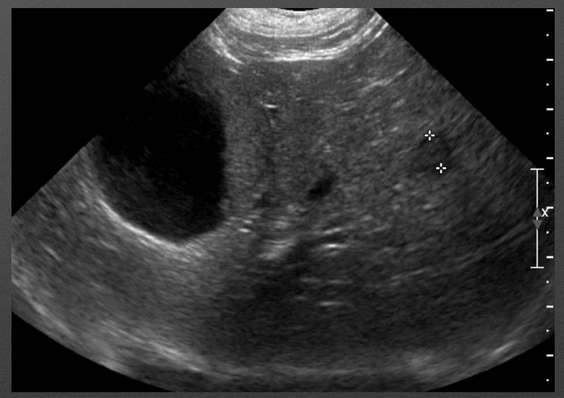
10-year-old Border Collie/cross presented for 8 weeks of vomiting, anorexia and weight loss



US findings

- Marked segmental wall thickening with altered layering
- Regional lymphadenomegaly
- Hepatic nodules





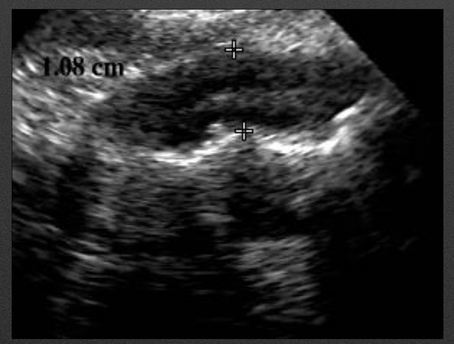
Cytology: blood contamination, possible mesenchymal neoplasm

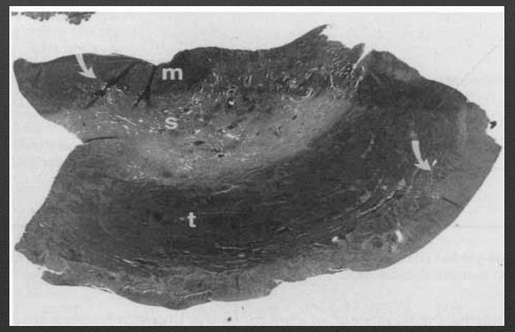
Necropsy: confirmed **gastric carcinoma**

with metastases to regional lymph nodes and liver

Ultrasonography of Canine Gastric Epithelial Neoplasia

Signalment, clinical and ultrasonographic findings from 16 dogs with histologically confirmed gastric epithelial neoplasia were reviewed. The most common clinical findings were vomiting, anorexia and weight loss. Hematemesis and melena were uncommon findings. Ten (10/16) dogs were female and there were four Chows. The most common ultrasonographic findings were transmural thickening of the gastric wall associated with altered wall layering. A poorly echogenic lining often was noted on the innermost and/or the outermost portions of the gastric wall, separated by a more echogenic central zone. The distribution of these changes was variable. This ultrasonographic feature, called pseudolayering, was present in 14 dogs. It was believed to most likely correlate to the unevenly layered tumor distribution noted histopathologically. The maximum wall thickening ranged from 1 cm to 2.7 cm. Regional lymphadenopathy was identified ultrasonographically in 15 dogs. Ultrasound-guided fine-needle aspiration biopsy or automated microcore biopsy, endoscopic biopsy, surgical biopsy or necropsy resulted in the diagnosis of carcinoma in 15 dogs and of carcinoid tumor in one dog. The results of this study suggested that ultrasonography was a useful tool for the detection and diagnosis of canine gastric epithelial neoplasia. Furthermore, ultrasonography can assist in obtaining diagnostic samples and in clinical staging of the tumor. *Veterinary Radiology & Ultrasound, Vol. 39, No. 4, 1998, pp 342–348.*



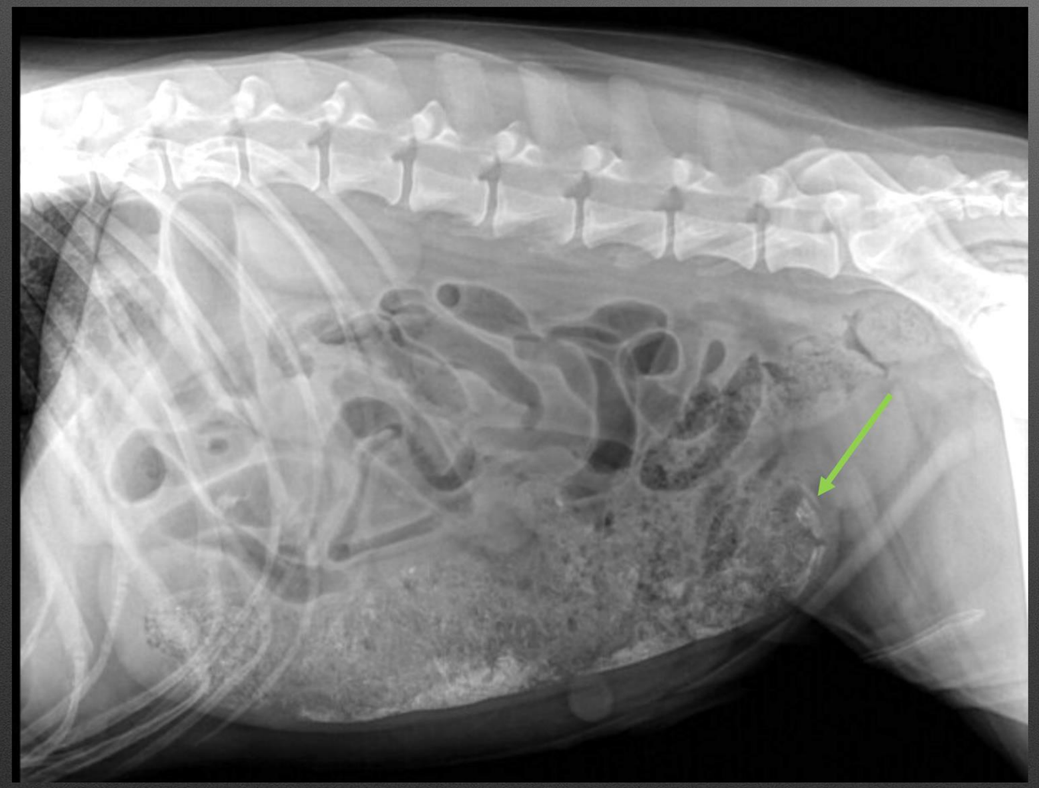


Penninck et al. Vet Radiol & US, 1998

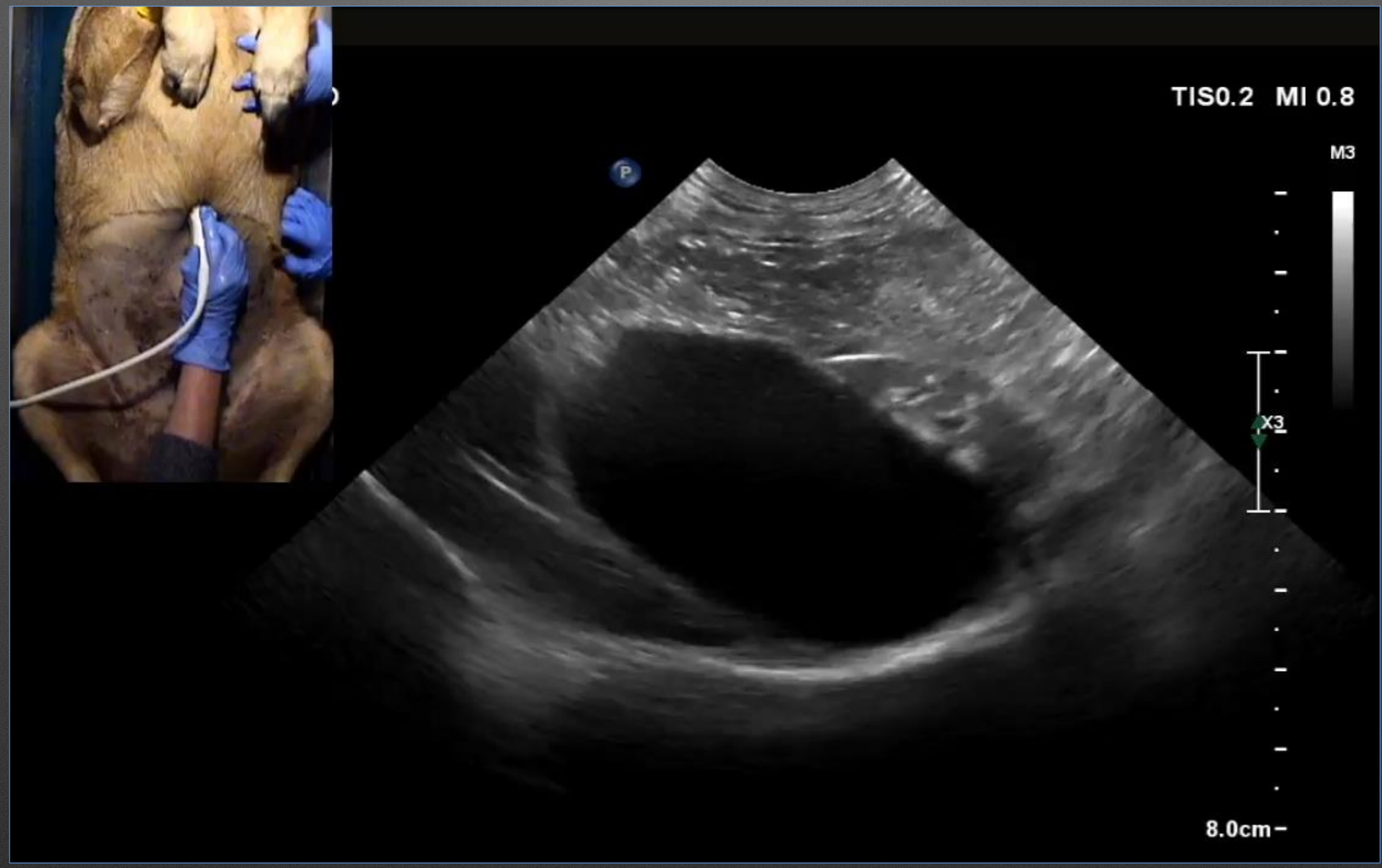
Carcinoma and Gastric Edema

Marked wall thickening (>1cm)
“spongy” appearance (edema)

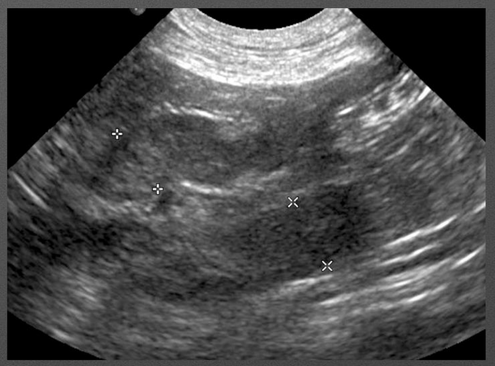
10-year-old Shepard-x with 1 month of weight loss, decreased appetite and vomiting/intermittent diarrhea. Physical exam and bloodwork are unremarkable.



Referral rads


TIS0.2 MI 0.8
M3
P
X3
8.0cm

Outcome

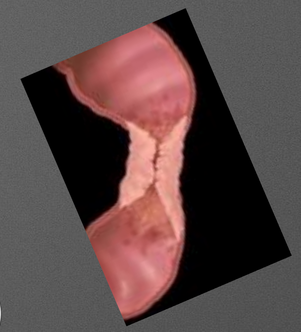


Foreign material accumulated at the stricture site (mid-jejunum)

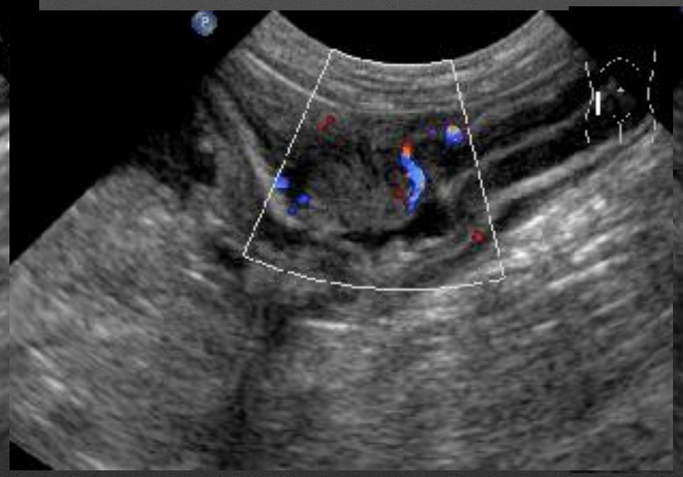
Histopath: adenocarcinoma and marked eosinophilic, lymphoplasmacytic enteritis

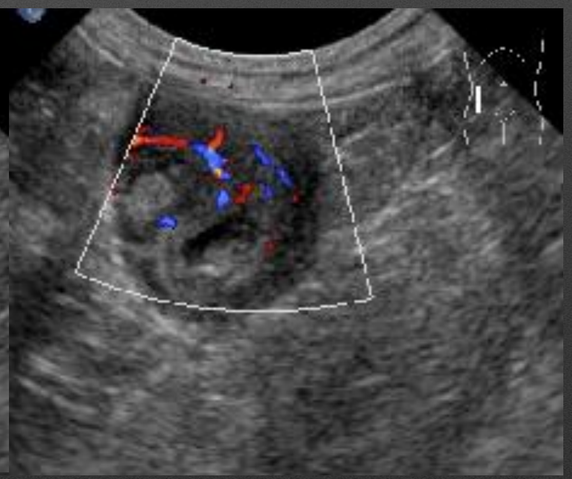
12-year-old cat presented for vomiting, decreased appetite, and weight loss for several weeks

Intestinal Carcinoma



- Focal thickening (short)
- Single
- Loss of layering
- Commonly obstructive



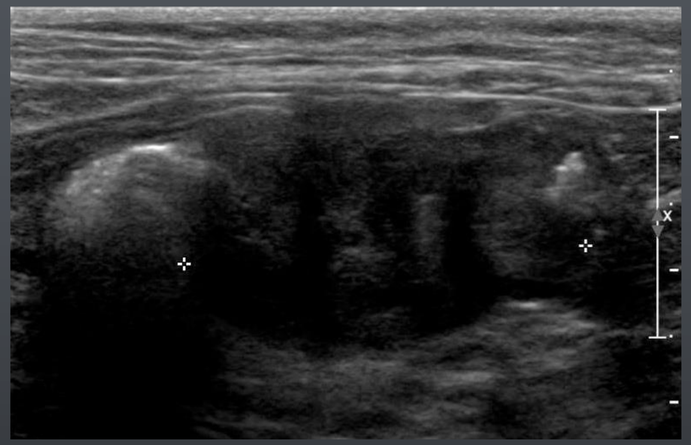


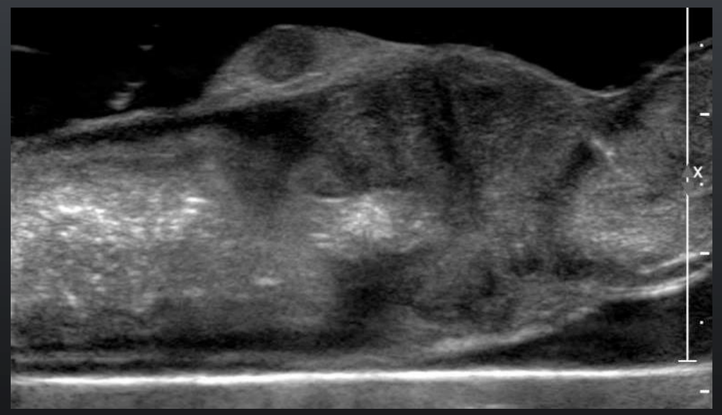
ULTRASONOGRAPHIC AND CLINICOPATHOLOGIC FINDINGS IN 21 DOGS WITH INTESTINAL ADENOCARCINOMA

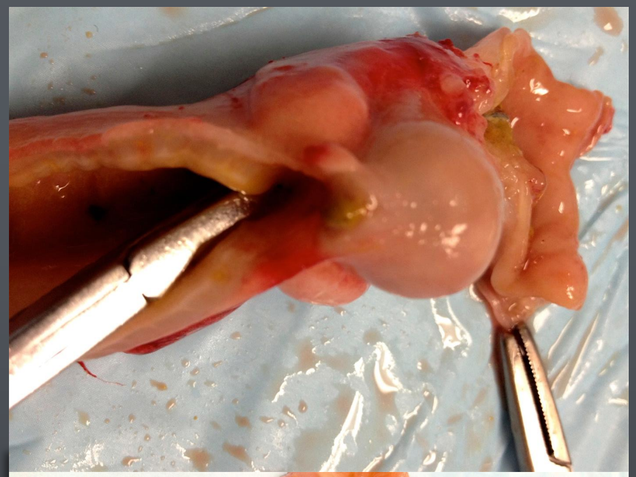
MELISSA C. PAOLONI, DVM, DOMINIQUE G. PENNINCK, DVM, DVSC, ANTONY S. MOORE, BVSC, MVSC

In a retrospective study of 21 dogs with intestinal adenocarcinoma, the signalment, clinical presentation, laboratory findings, ultrasonographic features, treatment, and outcome were reviewed. Anorexia (n = 16), vomiting (n = 15), diarrhea (n = 10), and weight loss (n = 9) were the most common clinical signs reported. Ultrasonographic features that were evaluated included location, length, wall thickness, echogenicity, regional motility, layering, regional lymphadenopathy, and fluid accumulation proximal to the lesion site. All lesions were transmural and associated with complete loss of wall layering. Maximum wall thickening at the lesion site ranged from 7 to 17 mm (median 12 mm, mean 11.9 mm). Most of the dogs had a lesion measuring from 23 to 63 mm in length, (median 40 mm, mean 42 mm). Most intestinal lesions were poorly echogenic and had an irregular lumen. Fluid accumulation proximal to the lesion site was identified in 17 of 21 dogs, and in 13 of 17 dogs the fluid accumulation was considered moderate to severe. Regional lymphadenopathy and/or nodular mesentery/omentum were noted in 12 of 21 dogs. The tumor was located in small intestine for 15 dogs and in the colon for the remaining 6 dogs. Fifteen dogs were treated by surgical resection of the intestinal mass. Their median survival time was 233 days. Only gender appeared to influence survival. Female dogs lived a median of 28 days, whereas male dogs lived a median of 272 days. *Veterinary Radiology & Ultrasound, Vol. 43, No. 6, 2002, pp 562–567.*

In another cat…







ULTRASONOGRAPHIC FEATURES OF INTESTINAL ADENOCARCINOMA IN FIVE CATS

BILL J. RIVERS, DVM, PHD, PATRICIA A. WALTER, DVM, MS, DANIEL A. FEENEY, DVM, MS, GARY R. JOHNSTON, DVM, MS

Adenocarcinoma, followed by lymphosarcoma, are the most common feline intestinal neoplasms. Clinicopathological, survey radiographic, and ultrasonographic findings of five cats with intestinal adenocarcinoma are reported. An abdominal mass was palpable in all five cats, but the mass could be localized to bowel in only two cats. Radiographically an abdominal mass was detected in only one cat. Ultrasonographically there was a segmental intestinal mural mass in all five cats. The mass was characterized by circumferential bowel wall thickening with transmural loss of normal sonographic wall layers. In one cat, the circumferential symmetric hypoechoic bowel wall thickening was similar to that reported for segmental lymphoma. In the other four cats, the sonographic features of the thickened bowel wall were varied, being mixed echogenicity and asymmetric in 3 cats and mixed echogenicity and symmetric in one. The results of the present report suggest that sonographic observation of mixed echogenicity segmental intestinal wall thickening in the cat represents adenocarcinoma rather than lymphosarcoma, although other infiltrative diseases should be considered. *Veterinary Radiology & Ultrasound, Vol. 38, No. 4, 1997, pp 300–306.*

13-year-old West Highland Terrier with 5 days of vomiting and 2 days of anorexia.

Large mass along lesser curvature was a leiomyoma

A 10-year-old CM Portuguese water dog was presented for chronic vomiting (10-month), unresponsive to diet trials.

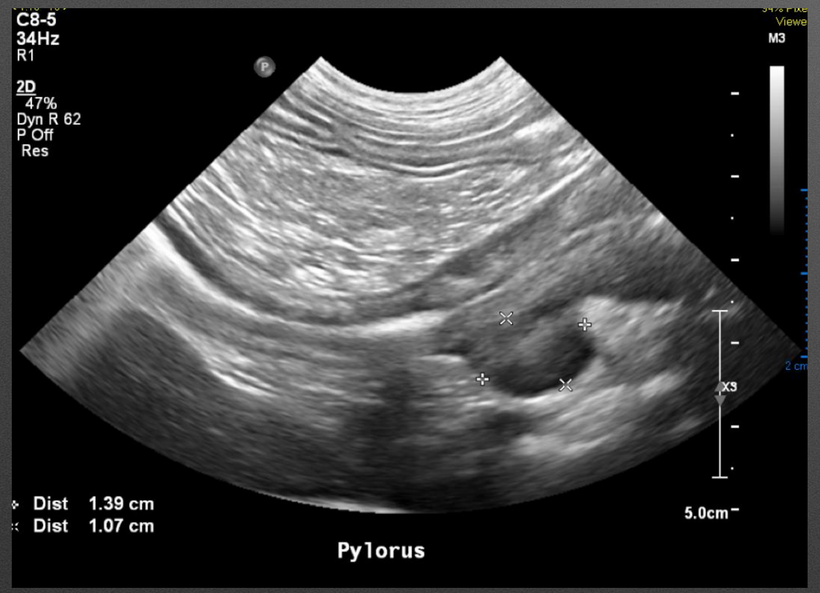
Large mass removed was a leiomyosarcoma

Gastric Angioleiomyoma

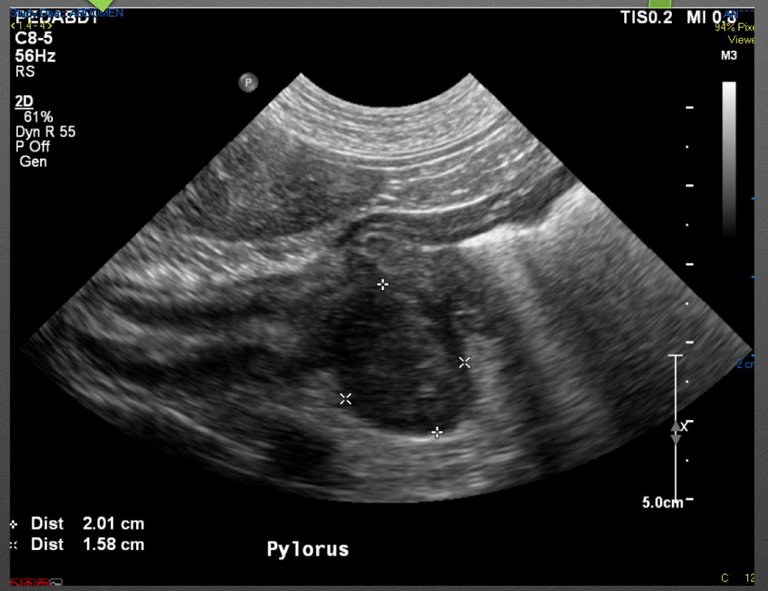
Three days ago, an11-year-old Hound mix vomited twice (food and coffee-ground). Now, the dog is anorexic and lethargic. While at the hospital, his PCV dropped to 14%.

While the dog received blood transfusion (250ml), he vomited again coffee-ground material. Melena also developed.

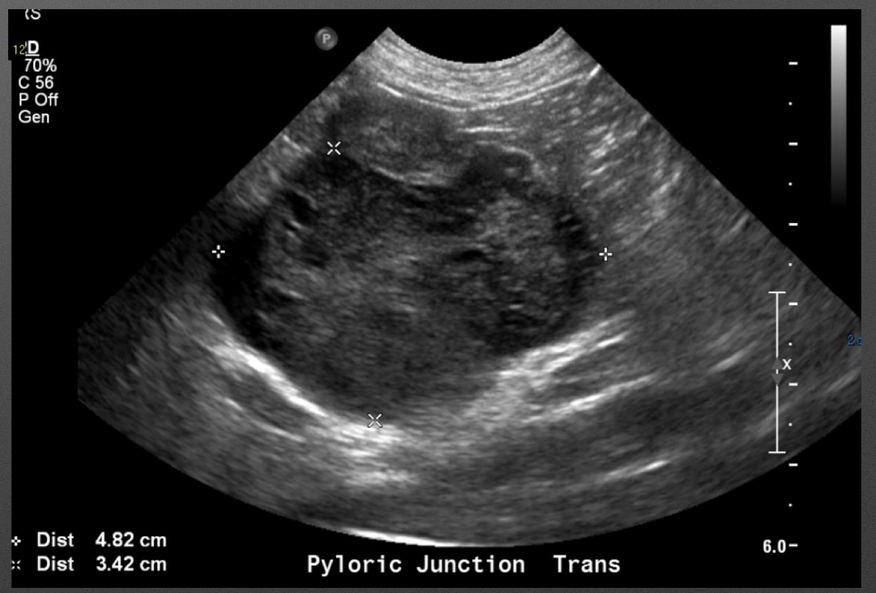
A 13-year-old CM Boston Terrier cross was presented for lethargy (1 month duration). He is worked up for chronic hepatopathy.



12/6/2019



1/25/2020



11/13/2020

Outcome

The mass was removed.

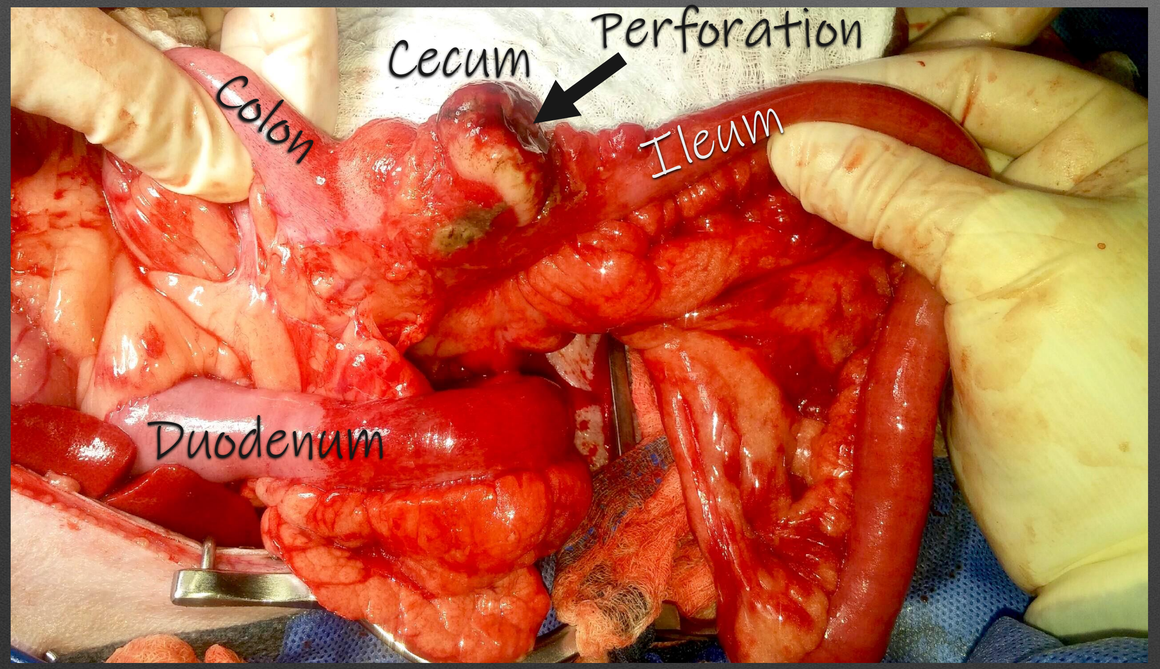
The histopathological diagnosis is mesenchymal tumor (pylorus), favoring Gastrointestinal stromal tumor or Leiomyosarcoma.

The neoplastic cells of the pyloric mass stain strongly positive with CD117 (c-kit) immunostain, consistent with a diagnosis of **gastrointestinal stromal tumor** (GIST).

Duke is a 10-year-old Bichon presented for acute vomiting (last night) and straining to defecate. The dog became suddenly very lethargic. The referral vet worried about pancreatitis. The dog is hypoglycemic (suspected sepsis), hypotensive, and hyperlactemic.

Outcome

A cecal mass was resected along with the ileum and part of the jejunum (abnormal peripheral tissue).



Histo: Stromal tumor confirmed by IHC

ULTRASONOGRAPHIC DIAGNOSIS OF GASTROINTESTINAL SMOOTH MUSCLE TUMORS IN THE DOG

NATHANIEL C. MYERS III, DVM, DOMINIQUE G. PENNINCK, DVM

Historical, physical examination, clinicopathologic, radiographic and ultrasonographic findings of 13 dogs with gastrointestinal (GI) smooth muscle tumors (11 leiomyosarcomas, 2 leiomyomas) were reviewed. History, including signalment and chief complaint, physical examination and bloodwork were neither sensitive nor specific for GI neoplasia. Imaging procedures, radiology and ultrasonography, detected the presence of abdominal masses in 12 patients, including 9 animals lacking a palpable mass on initial examination. Survey radiographs of 10 of the 13 dogs revealed a mass effect in 5/10 dogs, evidence of peritoneal effusion or free abdominal gas in 3/10 dogs, and an obstructive pattern with gas and fluid distension of the intestinal tract in 1/10 dogs. Ultrasonography identified an abdominal mass in 12/13 dogs, and peritoneal effusion in 5 animals. Ultrasonography correctly recognized an association of the mass with bowel segments by the presence of intraluminal gas, within or adjacent to the mass effect, in 10 dogs, and strongly suggested an intestinal origin in one additional animal. GI smooth muscle tumors often appeared as large masses, eccentrically projecting from the bowel wall, frequently containing single or multiple hypo/anechoic regions. Based on this study we conclude that ultrasonography is more sensitive than survey radiography in the detection of GI smooth muscle tumors, and may present specific features to distinguish smooth muscle tumors from other types of GI tumors. Ultrasonography is recommended as a screening procedure for cases where GI neoplasia is suspected.
Veterinary Radiology & Ultrasound, Vol. 35, No. 5, 1994, pp 391–397.

Reclassification of Small Intestinal and Cecal Smooth Muscle Tumors in 72 Dogs: Clinical, Histologic, and Immunohistochemical Evaluation

CERIEL P.H.J. MAAS, DVM, GERT TER HAAR, DVM, Diplomate ECVS, INGRID VAN DER GAAG, DVM, PhD, Diplomate ECVP, and JOLLE KIRPENSTEIJN, DVM, PhD, Diplomate ACVS & ECVS

Objectives—To reclassify canine small intestinal and cecal leiomyoma (LM) and leiomyosarcoma (LMS) into smooth muscle and gastrointestinal stromal tumors (GIST) using histologic and immunohistochemical (IH) analysis and to report clinical findings and survival data.
Study Design—Retrospective review of cases.
Animals—Dogs (n = 47) with small intestinal (40 LMS; 7 LM) and 25 dogs with cecal tumors (23 LMS; 2 LM).
Methods—Clinical and survival data were reviewed. Tissue sections were reevaluated for light-microscopic malignancy criteria and examined for expression of SMA, desmin, vimentin, S-100, and CD117 (KIT) by immunohistochemistry.
Results—Reclassification resulted in 2 LM, 9 LMS, 19 GIST, and 17 GIST-like tumors in the small intestine and 23 GIST and 2 GIST-like tumors in the cecum. GIST-like tumors were morphologic and IH identical to GIST but lacked KIT expression. No significant difference in survival was observed for tumor type, location, histologic, or IH characteristics; however, dogs with cecal tumors were significantly older in age, presented more commonly with intestinal perforation and peritonitis, and less commonly with weight loss. Cecal tumors had more histologic malignancy criteria than small intestinal tumors. After excision, 1 and 2 year recurrence-free periods were 80.1% and 67.2% for small intestinal and 83.3% and 61.9% for cecal tumors.
Conclusion—Prognosis for intestinal tumors with histologic smooth muscle appearance is good after excision and not related to tumor type, location, histologic, or IH characteristics.
Clinical Relevance—Clinical importance could not be demonstrated for reclassification, but may be for future treatment, of intestinal smooth muscle or stromal tumors.
© *Copyright 2007 by The American College of Veterinary Surgeons*

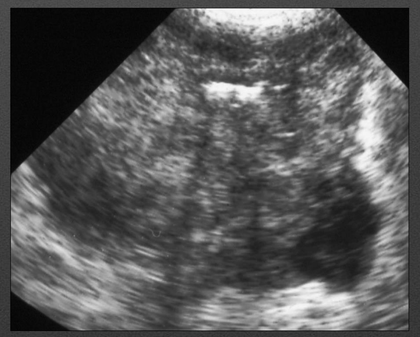
ULTRASONOGRAPHIC FEATURES OF CANINE GASTROINTESTINAL STROMAL TUMORS COMPARED TO OTHER GASTROINTESTINAL SPINDLE CELL TUMORS

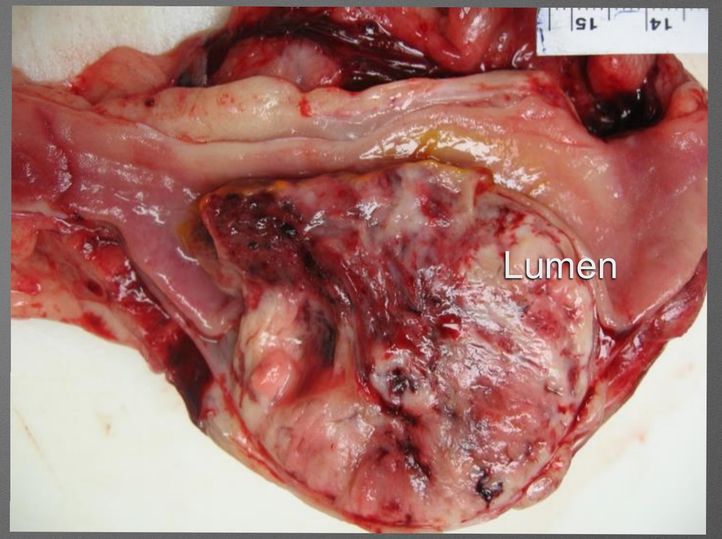
JOSHUA HOBBS, JAMES SUTHERLAND-SMITH, DOMINIQUE PENNINCK, SAMUEL JENNINGS, LISA BARBER, BRUCE BARTON

Canine gastrointestinal stromal tumors (GISTs) are a recent subtype of gastrointestinal spindle cell tumor recognized with the increasing use of immunohistochemistry. To our knowledge, no imaging features have been described in immunistochemically confirmed canine GISTs. The objective of this retrospective, cross-sectional study was to describe ultrasonographic features of canine GISTs compared with other spindle cell tumors. Thirty-seven dogs with an ultrasonographically visible gastrointestinal mass and a histopathologic diagnosis of spindle cell neoplasia were examined. Immunohistochemistry staining was performed for retrieved tissue samples to further differentiate the tumor type and each sample was interpreted by a single veterinary pathologist. Ultrasonographic features recorded examined included mass echogenicity, homogeneity, presence of cavitation, layer of origin, bowel wall symmetry, and loss of wall layering, location, size, vascularity, and evidence of perforation or ulceration. Tumor types included 19 GISTs, eight leiomyosarcomas, six leiomyomas, and four nonspecified sarcomas. Gastrointestinal stromal tumors were significantly more likely to be associated ($P < 0.03$) with abdominal effusion than other tumor types. There was overlap between the anatomical locations of all tumors types with the exception of the cecum where all eight tumors identified were GISTs. Besides location, there were no unique ultrasound features of GISTs that would allow distinction from other gastrointestinal spindle cell tumors. Similar to previous studies, GISTs appeared to be the most common spindle cell tumor associated with the cecum in our sample of dogs. The high frequency of abdominal effusion with GIST's was of unknown etiology could possibly have been due to septic peritonitis. © 2015 *American College of Veterinary Radiology.*

Common Features of Spindle cell tumors SMT and GIST

- Eccentric/exophytic mass
- Often large at time of diagnosis
- Cavitation component (> 3cm)
- Uncommon lymphadenopathy
- Uncommonly obstructive
- Can be associated with intussusception

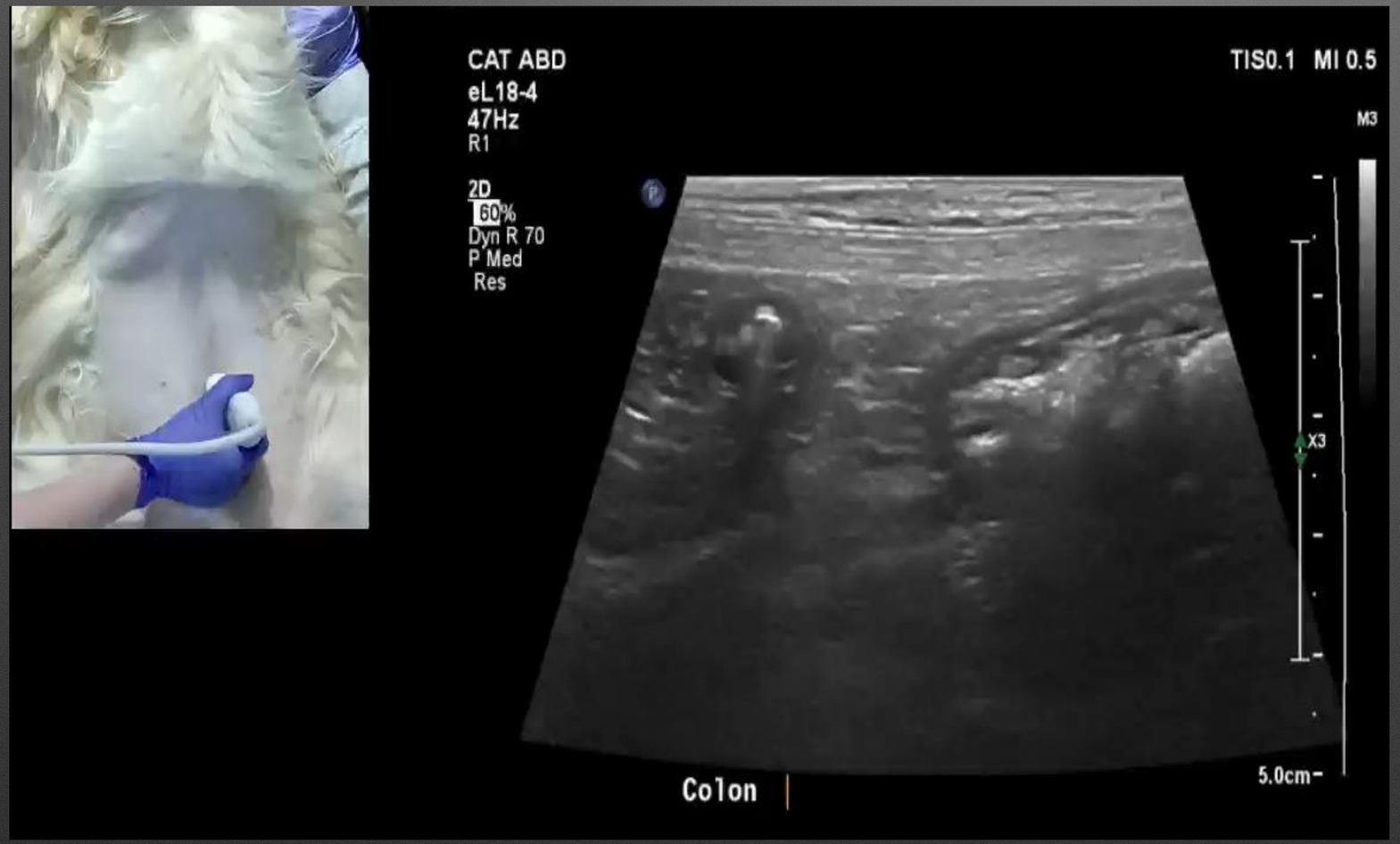




The histological features of the jejunal mass are most consistent with an intermediate grade (low mitotic rate but extensive necrosis and hemorrhage) gastrointestinal stromal tumor (GIST). Immunohistochemistry for smooth muscle actin and c-kit would be needed to confirm.

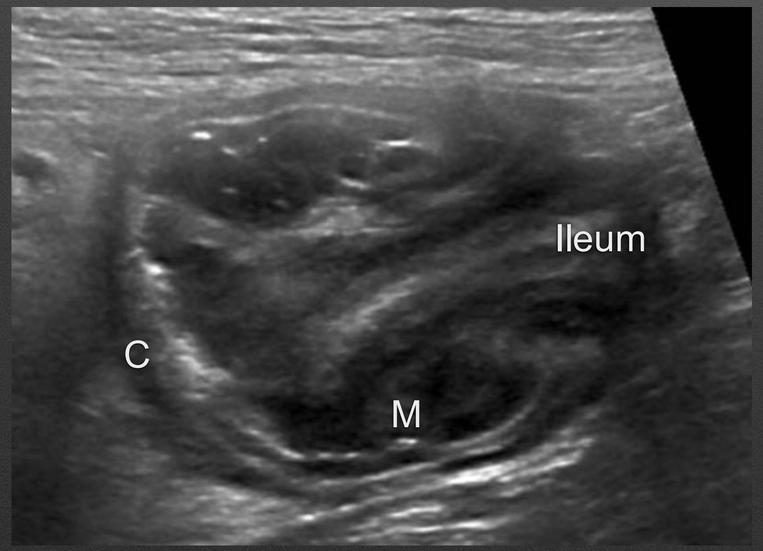
The histological features of the jejunal mass are consistent with GIST and there was concurrent marked chronic eosinophilic and lymphoplasmacytic enteritis

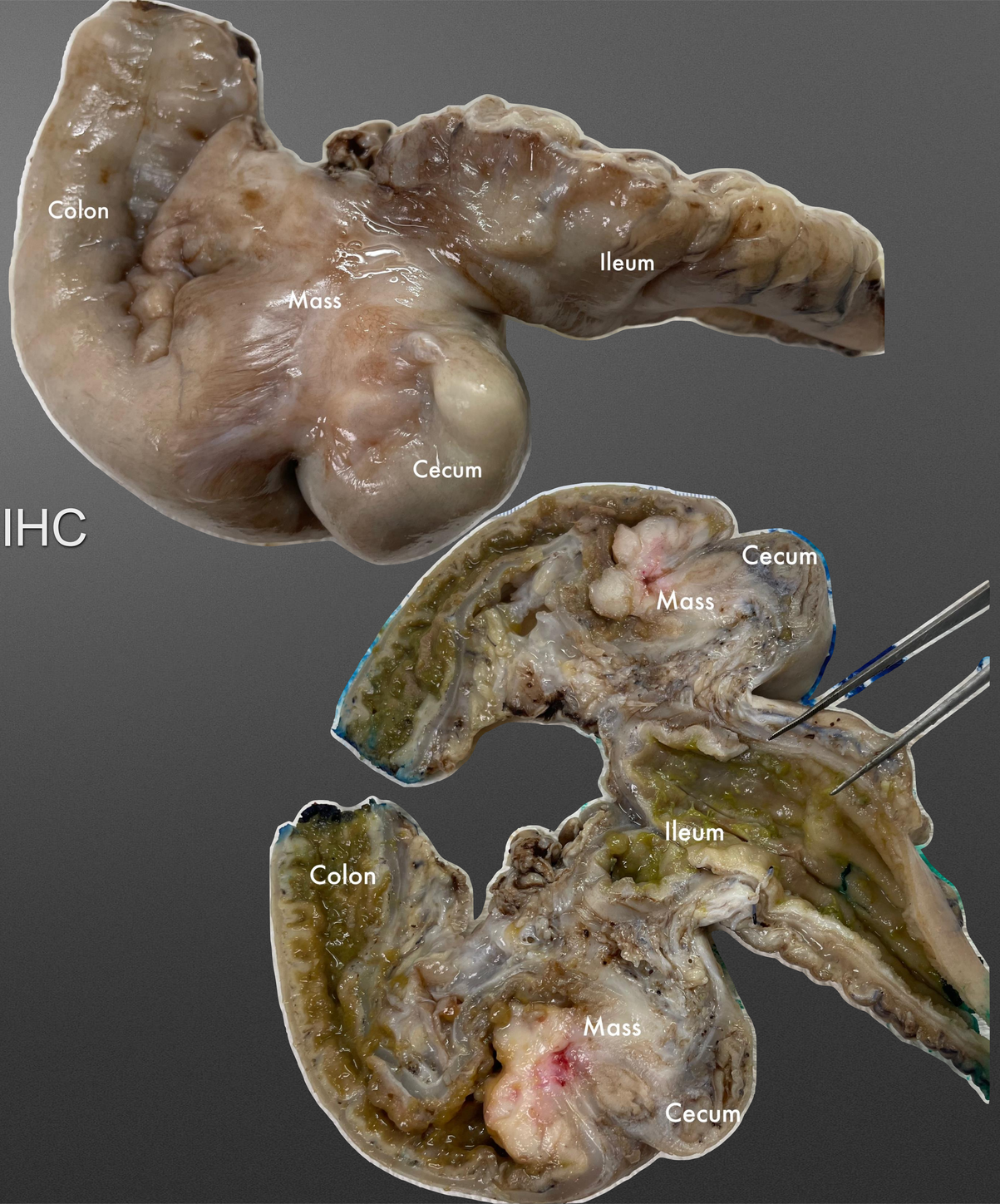
7-year-old Golden Retriever had diarrhea and occasional vomiting for 3-4 weeks. Blood noticed in diarrhea.



Outcome

- Went to surgery
- Histopath: malignant spindle cell tumor. IHC confirmed **leiomyosarcoma**





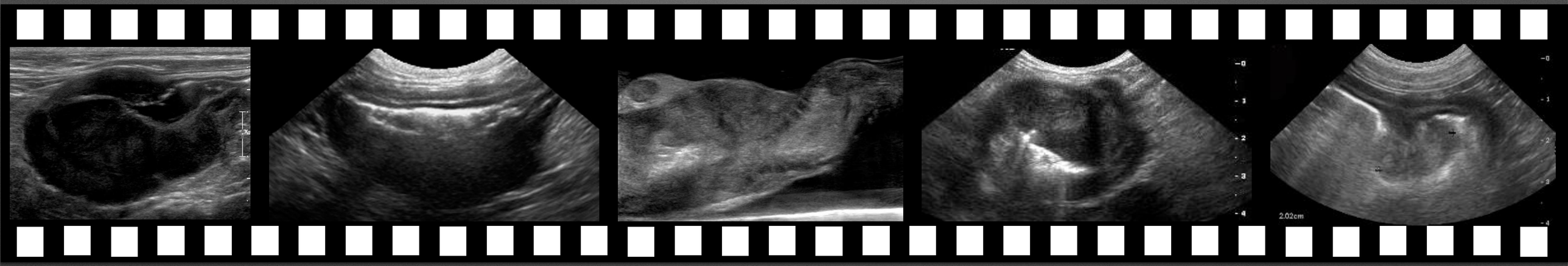
Take home message

	Location	Wall distribution	Layering/ length	obstructive	LN	ulceration	mineralization
Round cell tumors	Anywhere, 1 or more	Mostly concentric	Lost-long	uncommon	+++	+	-
Carcinoma	SI or colon	Concentric	Lost to Altered (stomach-colon?) Short	common	+++	+	+
Spindle cell tumors	Anywhere	Eccentric	~	uncommon	(-)	(-)	_

Questions ?

GI Nodules and Masses: Pseudo-tumors

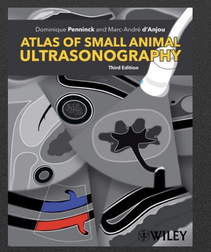
Part 2



Dominique Penninck, DVM, PhD, DACVR, DECVDI

Professor, Diagnostic Imaging, Tufts University

SmallAnimalUltrasonography.com & Atlas of Small Animal Ultrasonography, 2025



Non-neoplastic nodules/masses

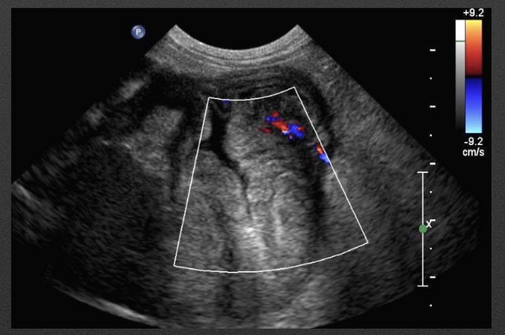
- Polyp/Adenomatous polyp
- Hypertrophic pyloric stenosis
- Feline Eosinophilic Sclerosing Fibroplasia
- Lipogranulomatous Lymphangitis
- Granulomas (infectious, post-trauma)

13-year-old (CM) toy poodle was presented for tetraparesis and progressive cough.
An abdominal ultrasound was performed as a baseline screening prior the MRI.

13-year-old (CM) toy poodle was presented for tetraparesis and progressive cough. An abdominal ultrasound was performed as a baseline screening prior the MRI.

Gastric polyp: marked, diffuse, mucosal hyperplasia with moderate, chronic, neutroph
and lymphohistiocytic gastritis with myriad bacteria

A 11-year-old Jack Russell Terrier with 8 weeks of diarrhea, polyphagia and weight loss. He has been vomiting 1-2 times/month for years (no progression)



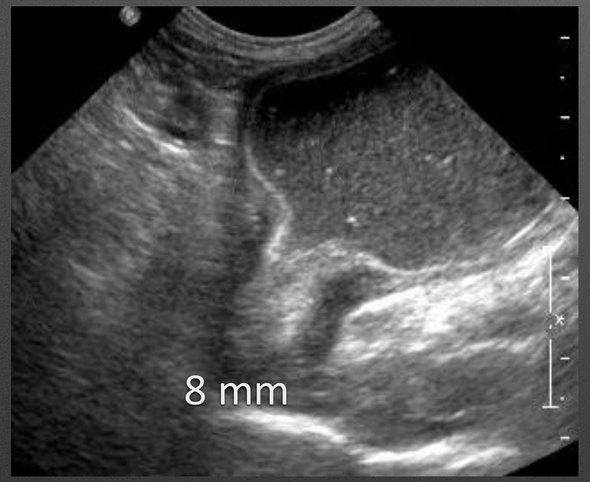
Ultrasonographic appearance of canine gastric polyps

Abstract

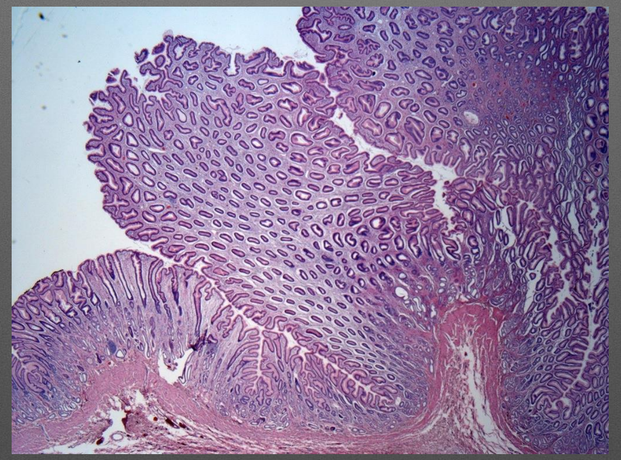
Benign gastric polyps are uncommon in dogs and most are discovered incidentally. Polyps protruding into the pyloric antrum can cause gastric outflow obstruction. Clinical and ultrasonographic findings in **seven dogs** with histologically confirmed benign mucosal gastric polyps were reviewed. Sonographic findings such as shape, size, echogenicity, location, evidence of gastric wall thickening, wall layering, and size of regional lymph nodes were recorded. Five sessile and two pedunculated masses of different sizes (range 7-60 mm) and echogenicities were found. They primarily arose from the mucosal layer and protruded into the gastric lumen. Only one dog had a large inhomogeneous mass with a poorly visualized gastric wall layering. The polyps were all single, and were located in **the pyloric antrum** in six out of seven dogs. Although the ultrasonographic appearance allowed a presumptive diagnosis of mucosal gastric polyp, the final diagnosis was determined from histopathologic examination.

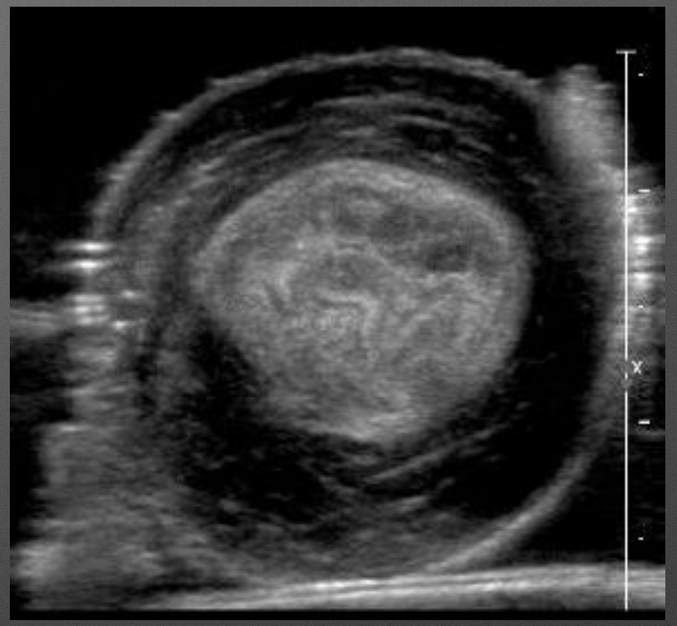
Diana A et al. Vet Radiol Ultrasound. 2009 Mar-Apr;50(2):201-4.

10-year-old Lhasa Apso, presented for chronic vomiting for 3 years (vomiting 1-2x/month). Increased lethargy and weight loss over last 6 months to 1 yr. Increased frequency of vomiting over last month, visually bloated to owner. A few days ago, the referral DVM did an ultrasound evaluation and noticed marked gastric fluid distention.



Comparison US water-bath & histopathology





Tubular adenomatous hyperplasia/adenoma with nodular hypertrophy of the tunica muscularis

1. Thickened muscular layer made of hypertrophied muscular fibers

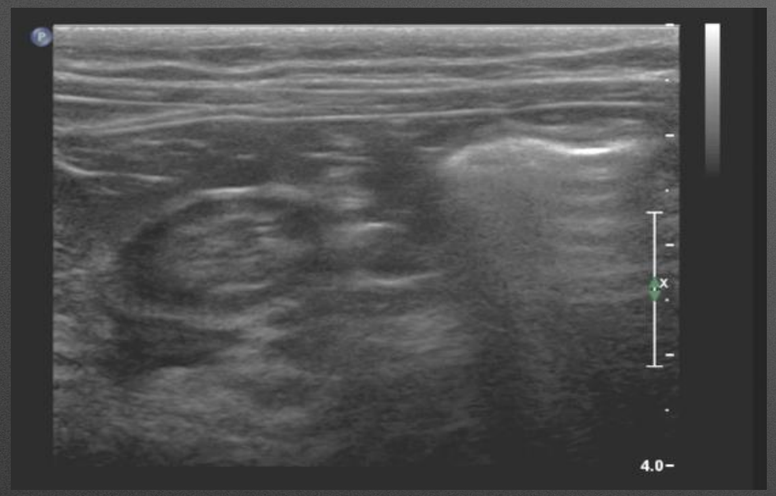
2. Mucosal hyperplasia and muscular hypertrophy

3.Mucosal hyperplasia with glandular+foveolar hyperplasia, glandular cystic dilation and various degrees of mucosal and submucosal inflammation

Biller DS. et al, Veterinary Radiology & Ultrasound 1994

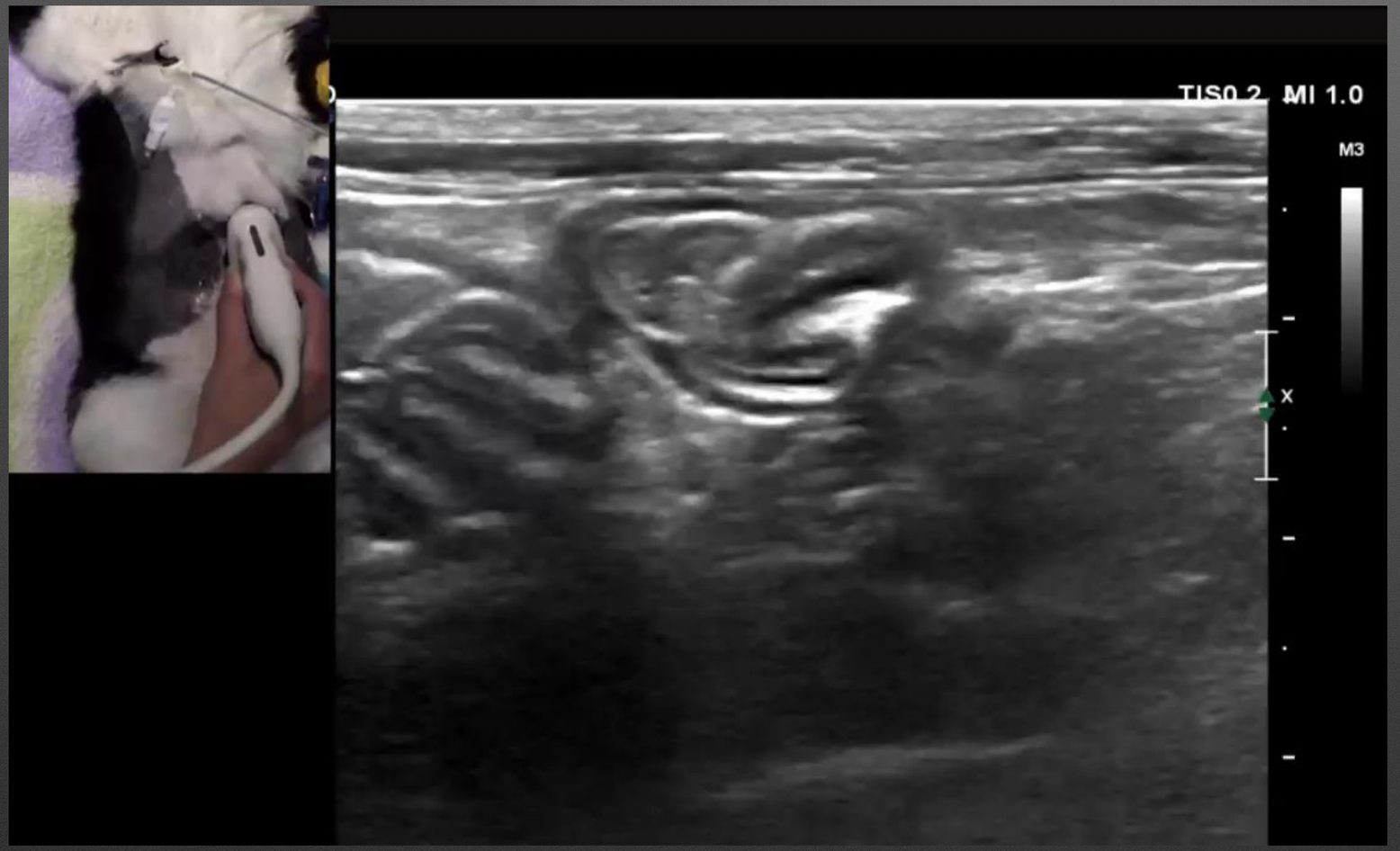
Adenomatous Polyp in Cats
Pyloro-duodenal region

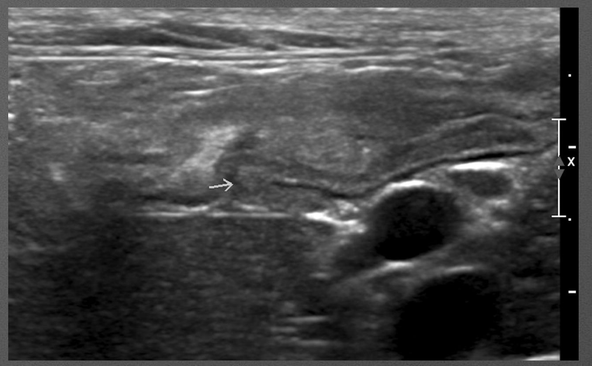
10-year-old ragdoll

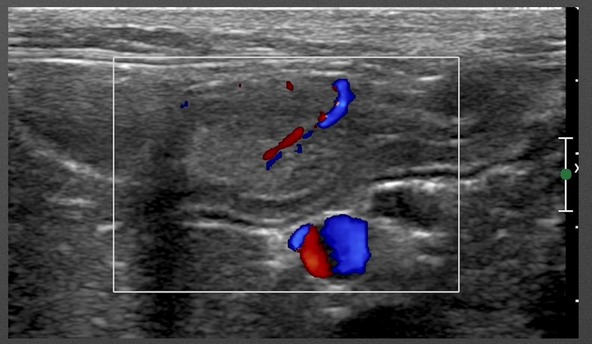


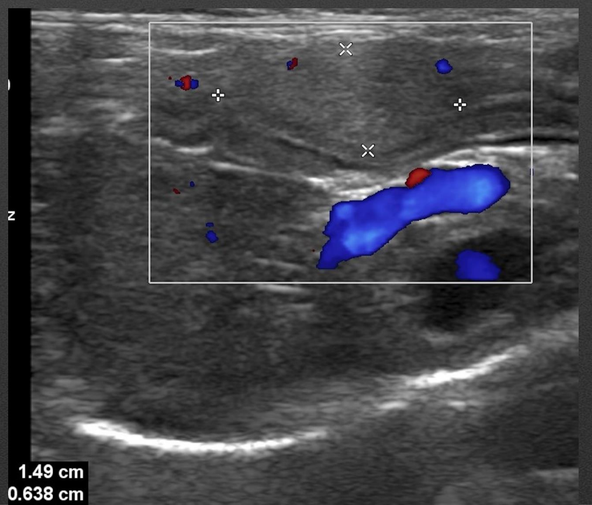
16-year-old cat with severe anemia and melena

Kira is a 2.5-year-old DSH, FS presented for acute lethargy and anorexia. She was hiding. She has very pale gums. On lab work, there is evidence of severe regenerative anemia (PCV 14%) with low total protein (4g/dl).









Ultrasonographic and clinicopathological features of pyloroduodenal adenomatous polyps in cats

Evence Daure[1], Rachel Jania[2], Samuel Jennings[3], Marc-André d'Anjou[4] and Dominique Penninck[1]

Journal of Feline Medicine and Surgery

Adenomatous polyps of the duodenum in cats: 18 cases (1985-1990)

Janet M. MacDonald, DVM; Holly S. Mullen, DVM; Scott D. Moroff, VMD

JAVMA, Vol 202, No. 4, February 15, 1993

Abstract

Objectives The aim of the study was to report the ultrasonographic and clinicopathological findings in cats with confirmed adenomatous pyloroduodenal polyps.

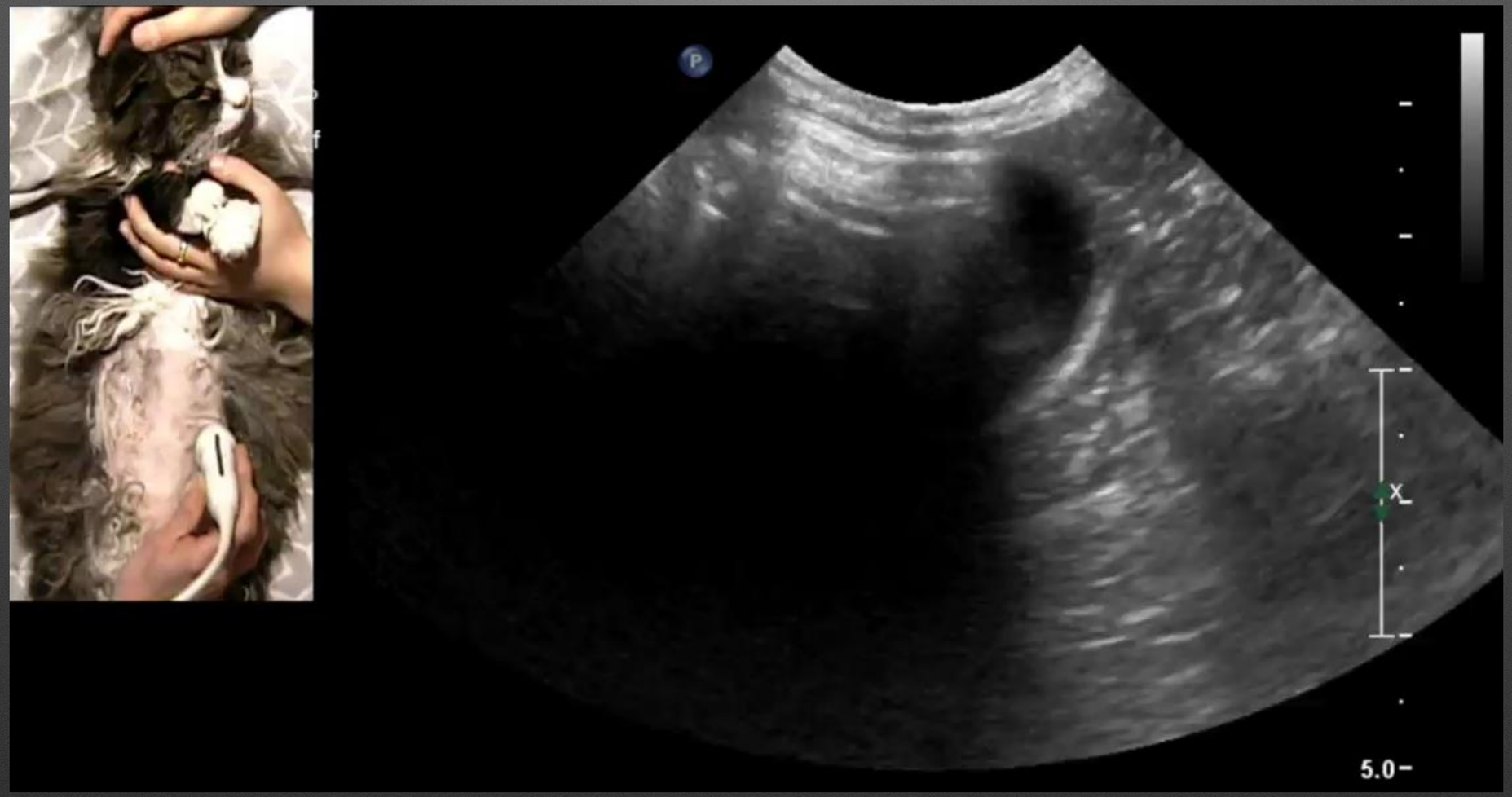
Methods Clinicopathological data, ultrasonographic and histopathological findings were collected retrospectively from medical records.

Results Pyloroduodenal polyps appeared as small moderately echogenic and homogeneous nodules filling most of the proximal duodenal or pyloroduodenal lumen. The most common presenting signs in this study included acute vomiting and anorexia in 4/6 cats and lethargy in 3/6 cats. Two cats presented with severe anemia, suggestive of active bleeding. One cat presented with increased bilirubin without anemia, suggestive of impaired bile flow. Five cats survived surgical removal of the polyp and were free of clinical signs 817 days after the procedure.

Conclusions and relevance Pyloroduodenal polyps have subtle ultrasonographic changes that can easily be mistaken for ingesta. They are characterized by a discrete small (up to 1.5 cm in diameter) homogenous echogenic nodule filling the pyloroduodenal lumen. Pyloroduodenal polyps are benign lesions but can cause severe clinical signs including gastrointestinal bleeding or biliary obstruction. Prognosis is excellent with surgical removal.

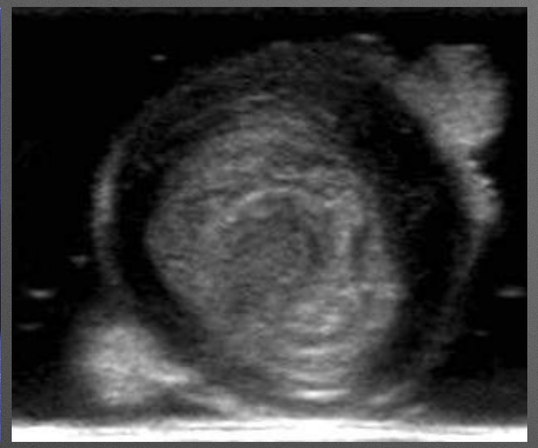
Journal of Feline Medicine and Surgery, 2015

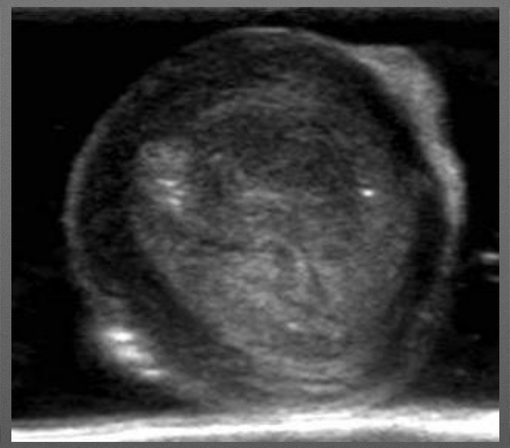
DSH cat, FS, 11-year-old was presented for 3-4 days of vomiting and lethargy. The cat was markedly dehydrated on presentation. History of CKD. Labwork: anemia, hypernatremia, hypokalemia, azotemia.



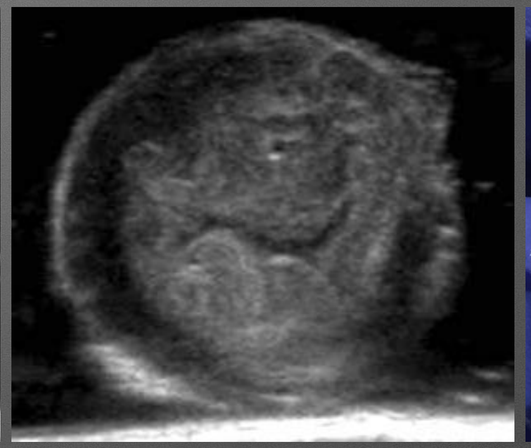
Pylorectomy was performed

Duodenal side

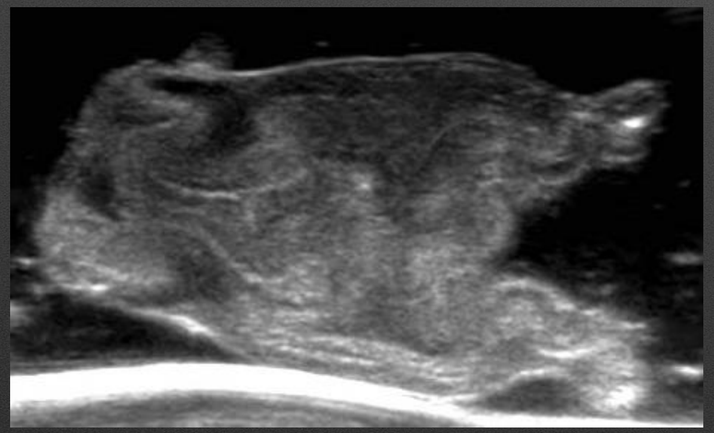


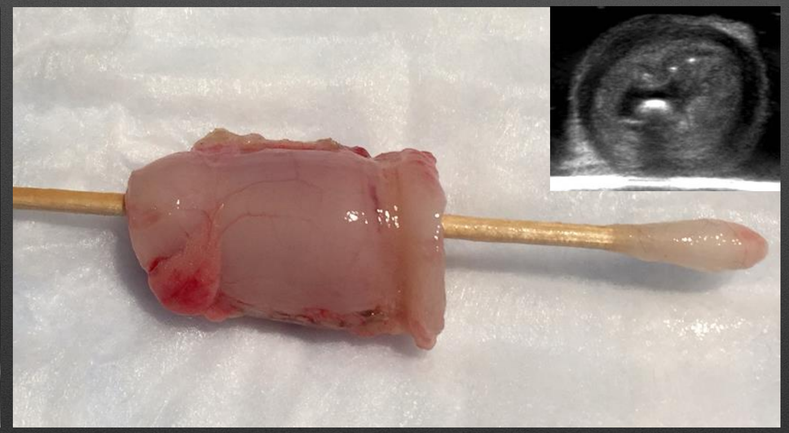


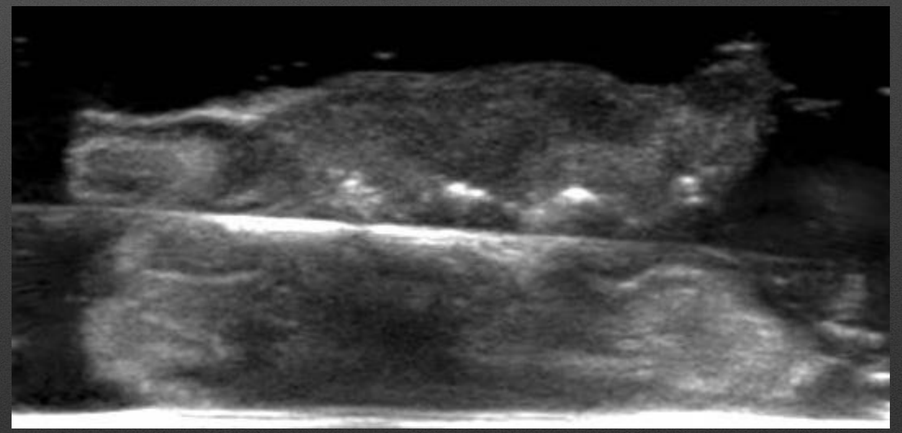
Specimen in water-bath



Pylorus side







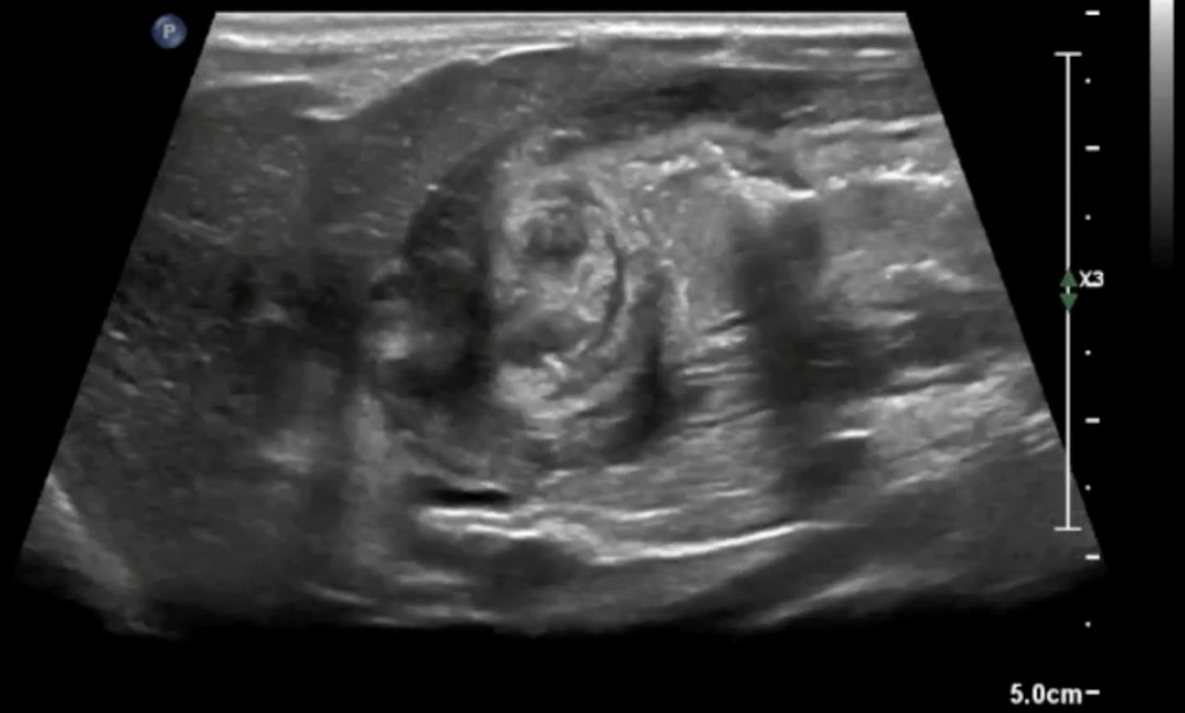
Outcome

Marked multifocal ulcerative gastritis with extensive granulation tissue

Comment: The main process occurring in this pylorus is ulceration, the cause of which is not clear but could be related to a number of common causes such as metabolic stress or NSAIDs. There were no neoplastic processes observed in this slide and no evidence to suggest eosinophilic sclerosing fibroplasia.

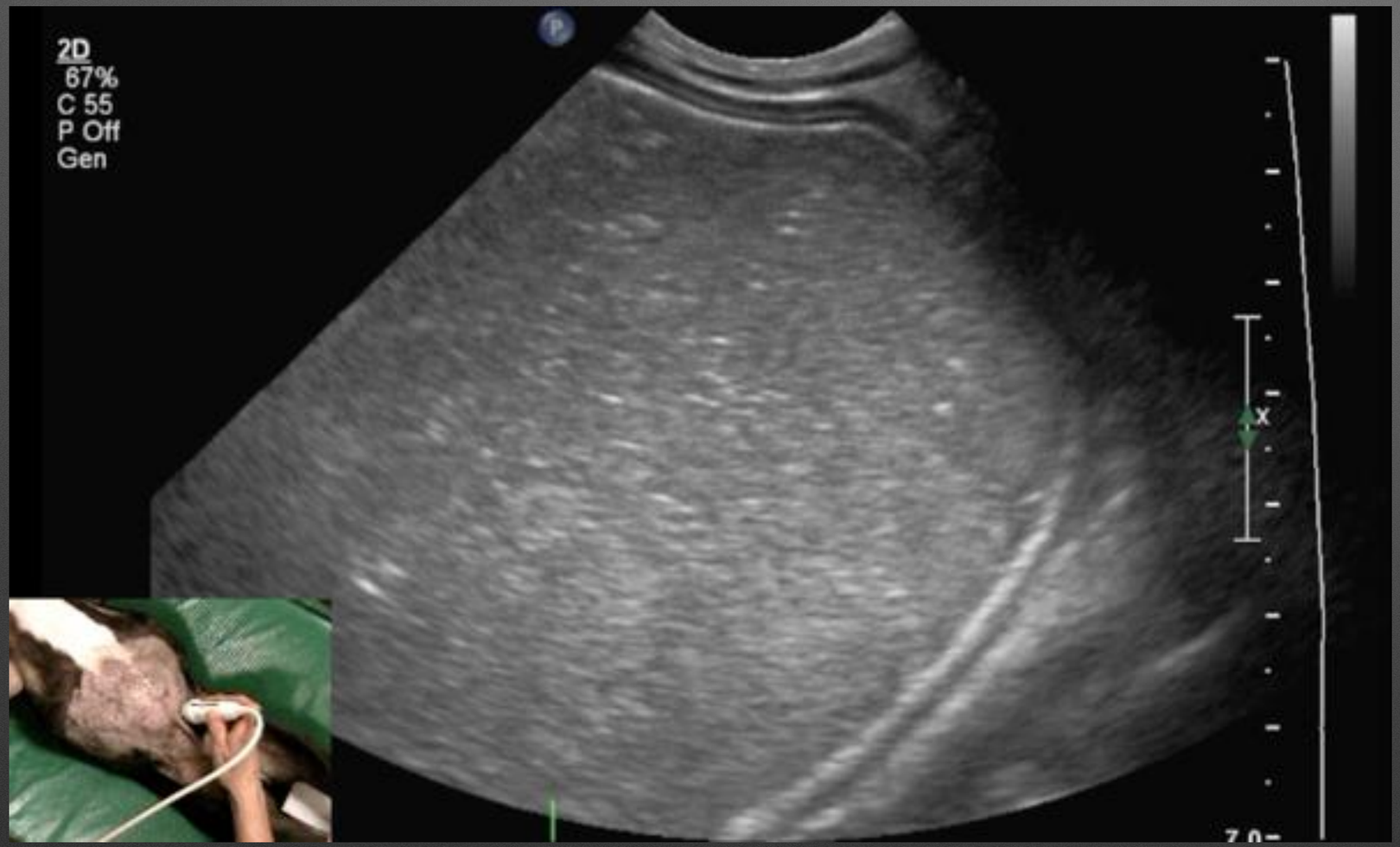
4-month-old French Bulldog with regurgitation, getting progressively worse

A large polyp with an undulated hyperechoic margin is present along the ventral antral wall.

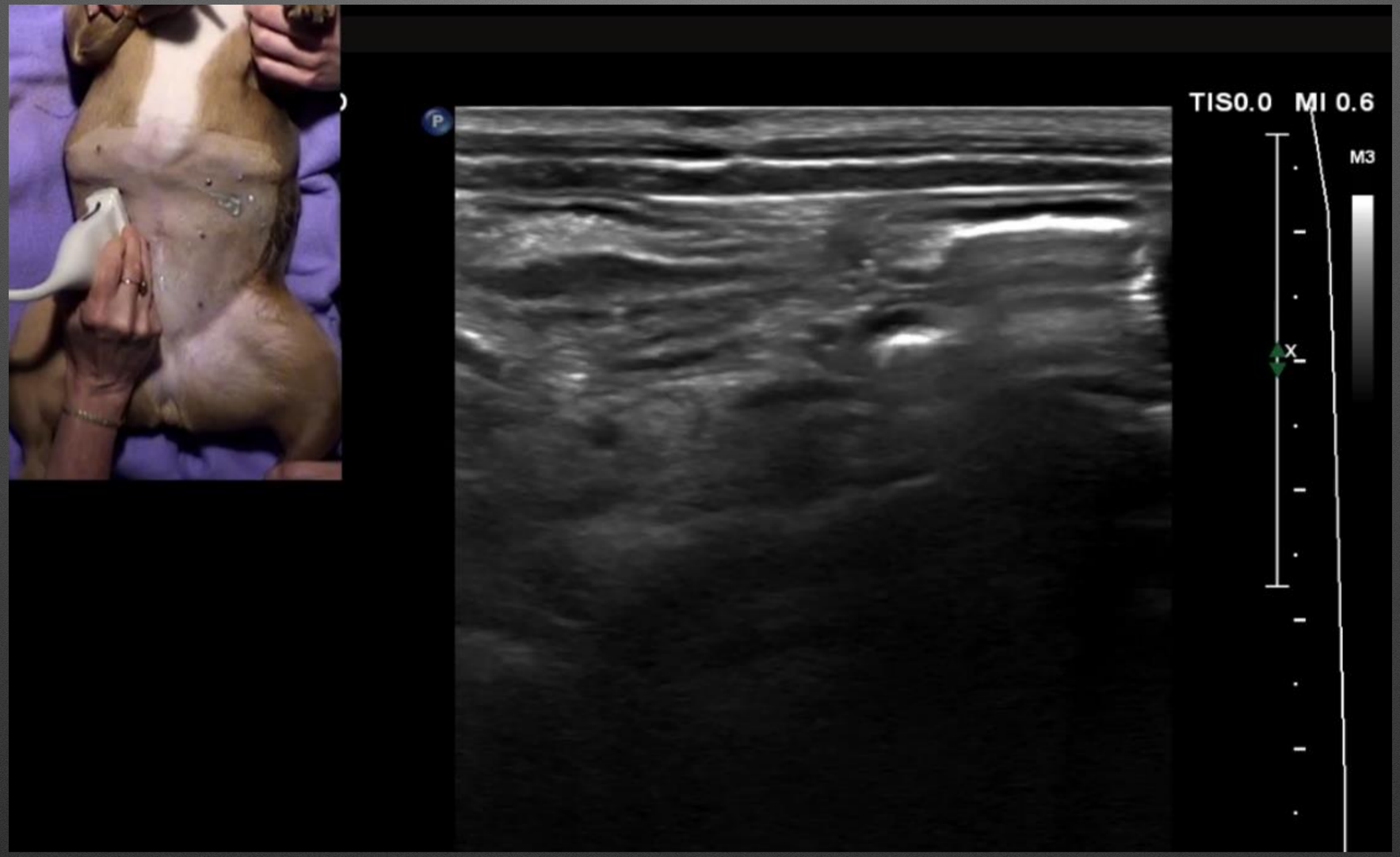


https://smallanimalultrasonography.com/time-to-play-31-the-answer/

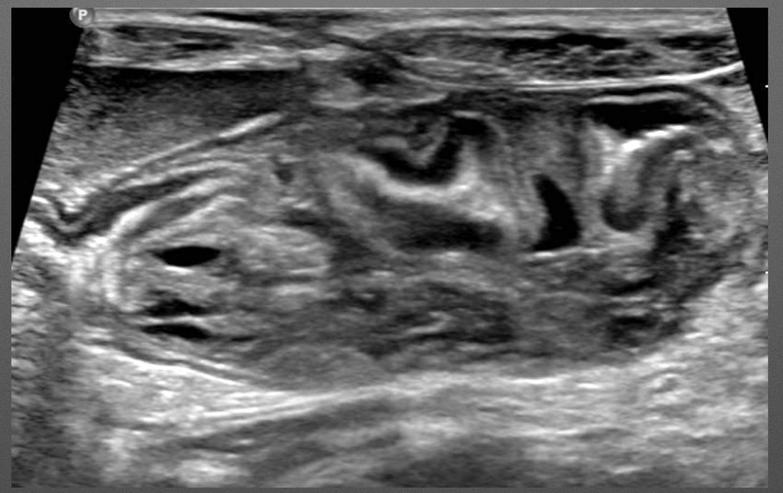
2-year-old French Bulldog with a history of chronic vomiting

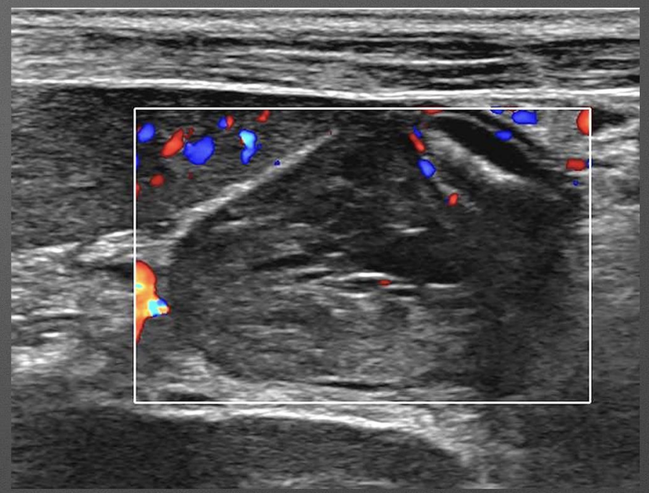


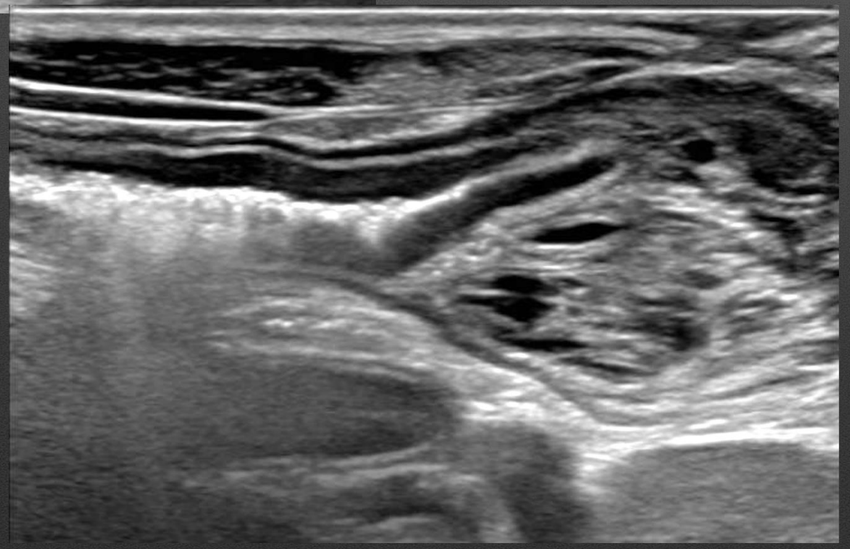
Olive is a 2-year-old French Bulldog presented for anorexia, vomiting, abdominal pain. She was not responding to primary care management.



Key Findings







Outcome

At surgery, a 10 cm long thickened jejunal segment was resected.

Histopathology: lipogranulomatous lymphangitis with extensive intramural hemorrhage

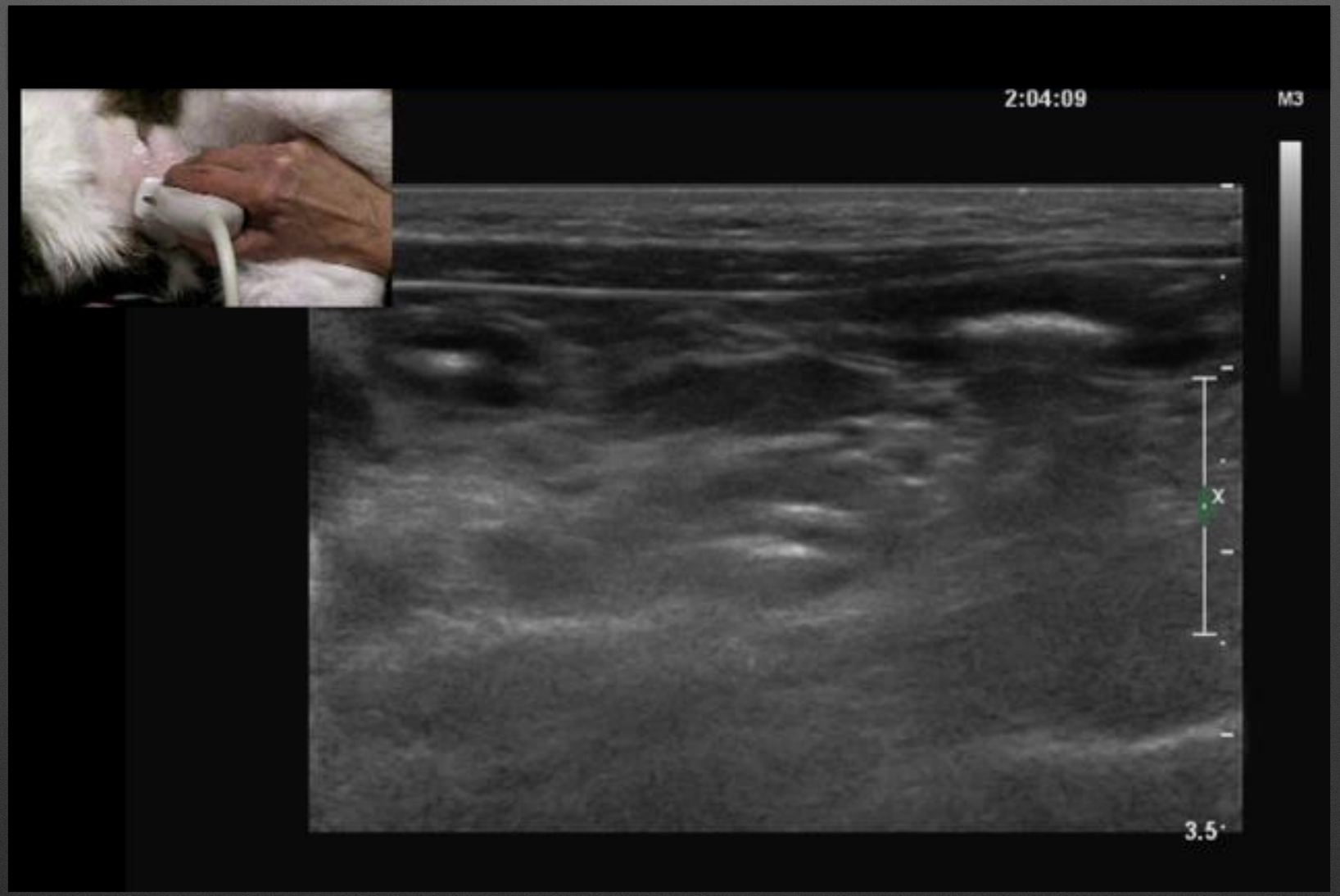
US features of lipogranulomatous lymphangitis in 10 dogs

Abstract

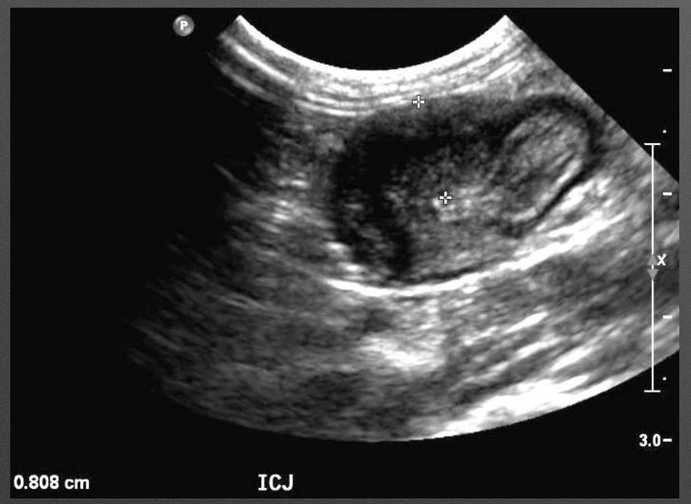
Intestinal lipogranulomatous lymphangitis (ILL) is a granulomatous inflammation of the lymphatic vessels of the intestinal wall and mesentery characterized by lipogranulomas. The purpose of this retrospective, multi-center, case series study is to report the ultrasonographic features of canine ILL. Ten dogs with a histologically confirmed ILL undergoing preoperative abdominal ultrasound were retrospectively included. Additional CT was available in two cases. Lesion distribution was focal in eight dogs and multifocal in two. All dogs presented with intestinal wall thickening and two had a concomitant mesenteric mass adjacent to the intestinal lesion. All lesions were in the small intestine. Ultrasonographic features were altered wall layering with predominantly muscular and to a lesser extent submucosal layer thickening. Other findings included hyperechoic nodular tissue within the muscular, serosa/subserosal, and mucosal layers, hyperechoic perilesional mesentery, enlarged submucosal blood/lymphatic vessels, mild peritoneal effusion, intestinal corrugation, and mild lymphadenomegaly. The two intestinal to mesenteric masses presented heterogeneous echostructure, predominantly hyperechoic with multiple hypo/anechoic cavitations filled with mixed fluid and fat attenuation content on CT. Histopathological findings included lymphangiectasia, granulomatous inflammation, and structured lipogranulomas affecting mainly submucosa, muscularis, and serosa. The intestinal to mesenteric cavitary masses revealed severe granulomatous peritonitis with steatonecrosis. In conclusion, ILL should be considered as a differential diagnosis for dogs with this combination of ultrasonographic features.

DeMagistris A. et al. Vet Radiol Ultrasound, 2023

A 4-year-old DSH presented for several weeks of inappetence and weight loss. He has hyperalbuminemia.

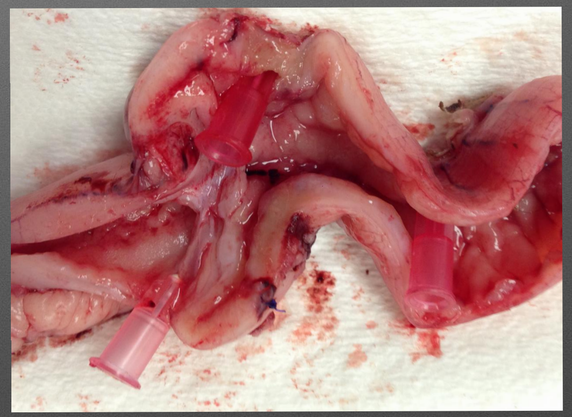


Key Findings



Outcome

FNAs: non conclusive diagnosis, no evidence of neoplasia



Surgery: ileum, cecum, proximal colon resection

Histopathology: marked, multifocal to coalescing, transmural, pyogranulomatous enterocolitis and lymphadenitis.

Immunohistochemistry for feline coronavirus has positive staining, confirming Feline Infectious Peritonitis

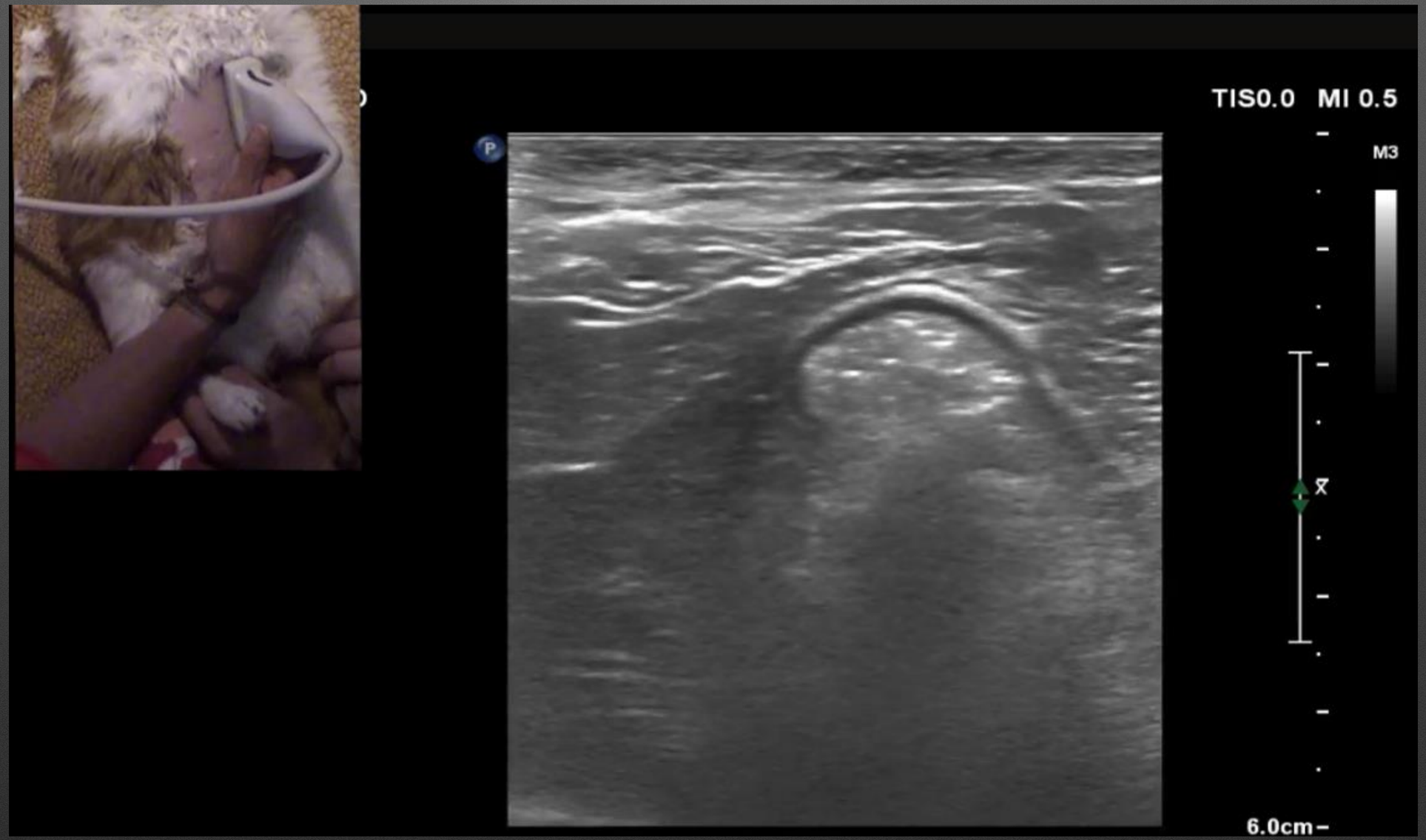
The abdominal ultrasonographic findings of cats with FIP: an update

In total, **25 cats** were included. Common clinical signs/pathology findings included hyperglobulinemia (96%), anorexia/hyporexia (80%) and lethargy (56%).

Abdominal ultrasound findings included effusion in 88% and lymphadenopathy in 80%. Hepatic changes were noted in 80%, the most common being hepatomegaly (58%) and a hypoechoic liver (48%). **Intestinal changes were noted in 68%** of cats, characterized by **asymmetric wall thickening and/or loss of wall layering**, with **52% being ileocecocolic junction and/or colonic in location**. Splenic changes were present in 36% of cats, including splenomegaly, mottled parenchyma and hypoechoic nodules. Renal changes were present in 32%, encompassing a hypoechoic subcapsular rim and/or cortical nodules. Mesenteric and peritoneal abnormalities were seen in 28% and 16% of cats, respectively. Most cats (92%) had two or more locations of abdominal abnormalities on ultrasound.

Müller T, Penninck D, Webster CRL, Conrado F JFMS 2023

14-year-old cat with chronic (years!) vomiting but in more recent weeks is hyporexic .



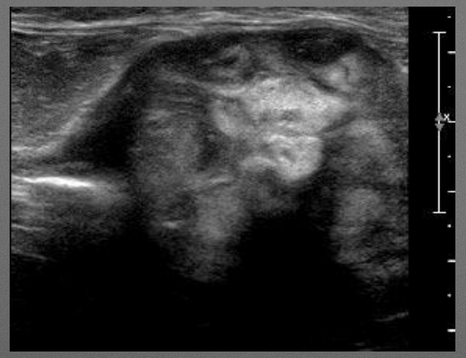
Outcome

Surgical resection of the ICJ/ileal mass

Histopathology: **feline eosinophilic sclerosing fibroplasia**

Had also concurrent intestinal small cell lymphoma (duod-jej)

10-year-old Ragdoll cat with acute onset of large bowel diarrhea and vomiting 2-3x/day



- Unique intramural inflammatory mass within the feline GI tract
- Eosinophilic inflammation, large reactive fibroblasts, and trabeculae of dense collagen. Often, bacteria (cocci) are found.
- Lesion was often grossly and sometimes histologically mistaken for neoplasia.

US and Clinicopathological Features of Feline Eosinophilic Sclerosing Fibroplasia in 4 Cats

Andrea Weissman[1], Dominique Penninck[1], Cynthia Webster[1], Silke Hecht[2], John Keating[1] and Linden E Craig[2]

Abstract

Four cats with feline gastrointestinal eosinophilic sclerosing fibroplasia (FGESF) are described. Clinical signs included decreased appetite, weight loss, vomiting and diarrhea. Bloodwork abnormalities included mild neutrophilia (n = 2) and hyperglobulinemia with concurrent hyperproteinemia (n = 2). Ultrasonographically, a total of five solitary masses with mural thickening and loss of layering were identified in the stomach, duodenum, jejunum and colon. In one cat a second, separate lesion was diagnosed 3 weeks following surgical resection of one mass. Histopathologically, lesions were characterized by collagen trabeculae and mixed inflammatory cell infiltrates, predominantly eosinophils. Multiple areas of necrosis were also noted, which contained bacteria in 2/4 cats. In two cats, changes consistent with FGESF were also noted in the liver. All cats had surgical resection of their lesions. Two cats are still living at time of publication (43 and 24 months post-surgery). FGESF should be considered as a differential for intestinal masses in cats.

J Feline Med Surg, 2013

Craig et al in Vet Pathol 46(1):63-70, 2009

Feline eosinophilic sclerosis fibroplasia

this entity should be added to the differential diagnoses list in cats with focal and inhomogeneous intestinal masses, especially if fine-needle aspirates or biopsies reveal the presence of eosinophilic inflammation, mast cells and fibroblasts

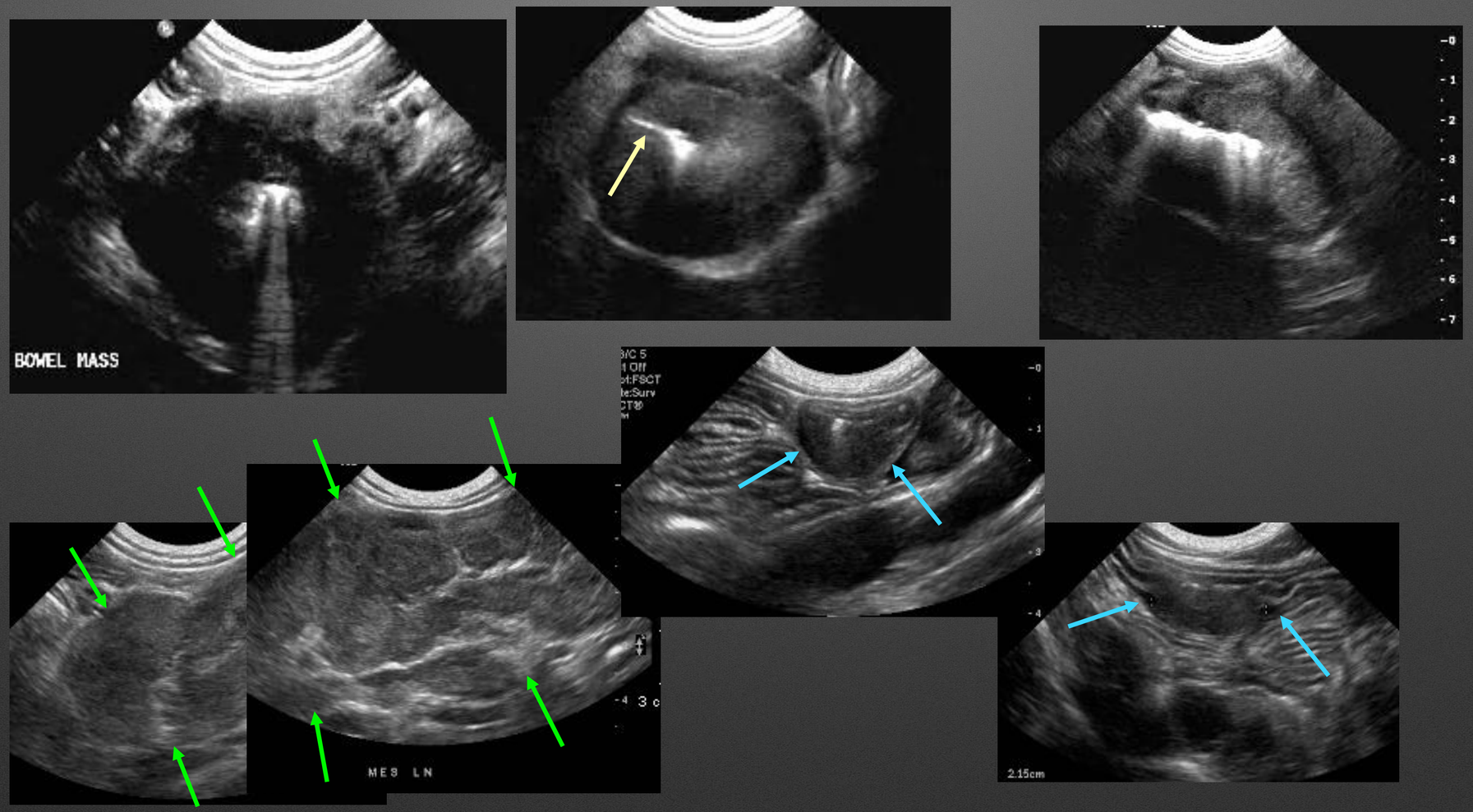
Clinicopathological findings, treatment, and outcome in 60 cats with GI eosinophilic sclerosing fibroplasia

Results: The median age was 5.4 years (interquartile range [IQR], 3.3-8.9.); 30% were Domestic Shorthairs and 12% were Domestic Longhair cats, with the most prevalent pedigree breeds being Ragdolls (25%), Exotic Shorthair (10%) and Persian (8%) cats. The median duration of clinical signs was 90 days (IQR, 17.5-247.0); the most common clinical signs were weight loss (60%), hyporexia/anorexia (55%), chronic vomiting (37%), lethargy (35%) and chronic diarrhea (27%). Masses were located in the small intestine (32%), stomach (27%), ileocolic junction (15%), colon (10%), lymph node (8%) and mesentery (8%) and 15% of cats had >1 mass. Eosinophilia was present in 50% and hypoalbuminemia in 28% of cats. The mass was removed surgically in 37% of cases. Most cats (98%) were treated with corticosteroids. Survival was not statistically different between cats treated with surgical resection and cats treated with medical therapy alone, 88% of the cats were still alive at the time of writing.

Conclusions and Clinical Importance: GESF is an important differential diagnosis for abdominal masses in cats, and has a much better prognosis than previously reported.

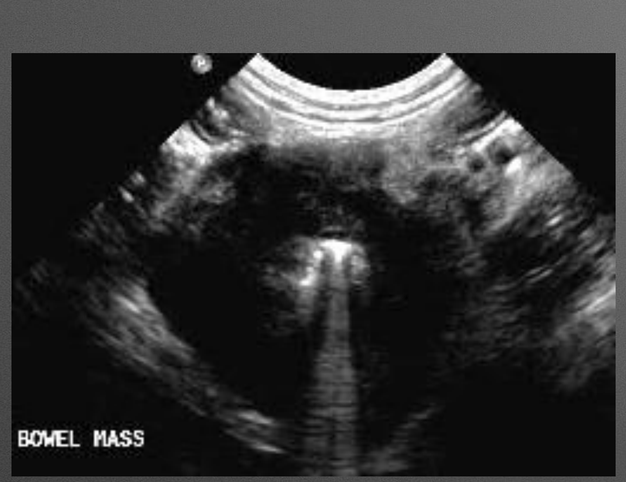
Cerná P. et al. J Vet Intern Med 2024

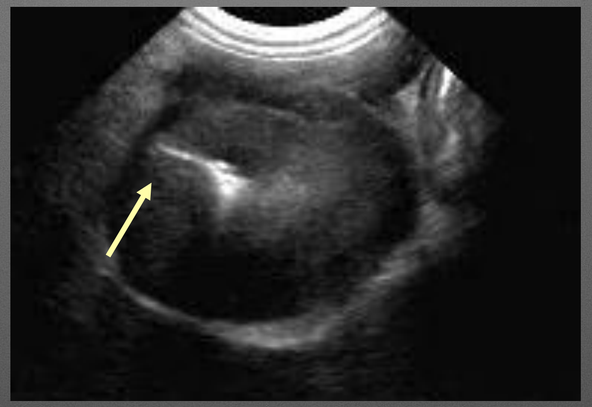
Multi-segmental Changes

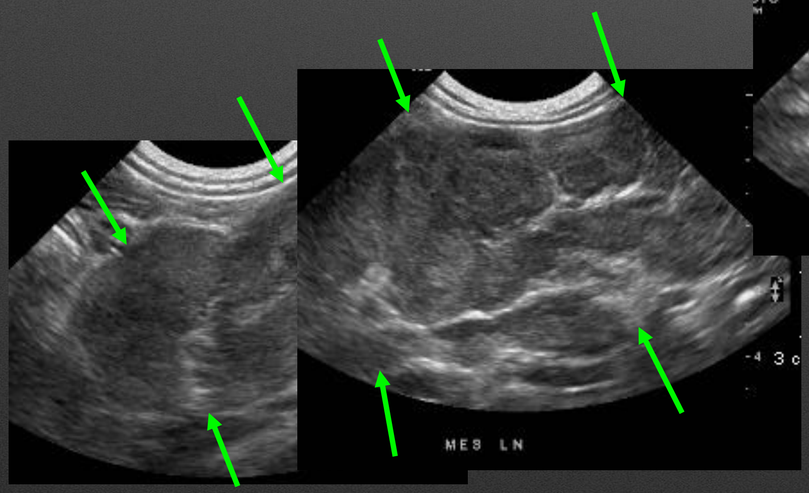


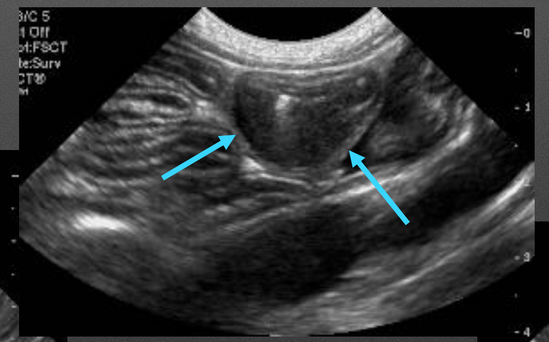
S171543

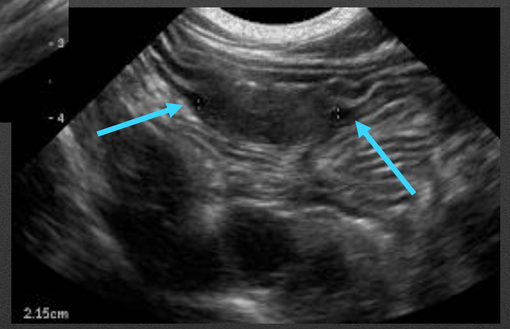
Granulomatous Enteritis (Cryptococcus)











S171543

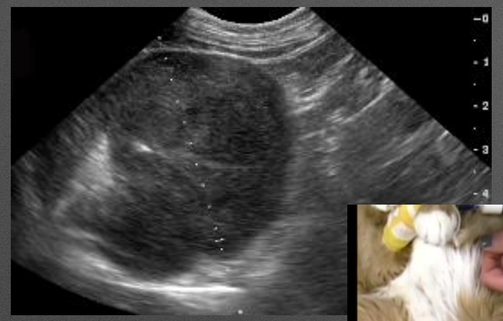
ULTRASONOGRAPHIC FEATURES OF CANINE GASTROINTESTINAL PYTHIOSIS

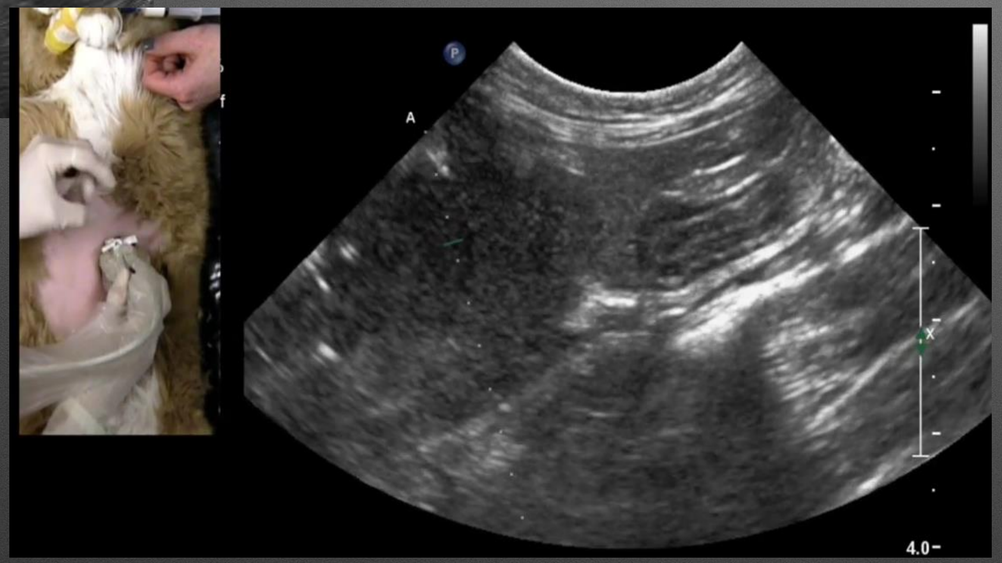
JOHN P. GRAHAM, MVB, MSc, SUSAN M. NEWELL, DVM, MS, GREGORY D. ROBERTS, DVM, MS, NOLA V. LESTER, BVMS

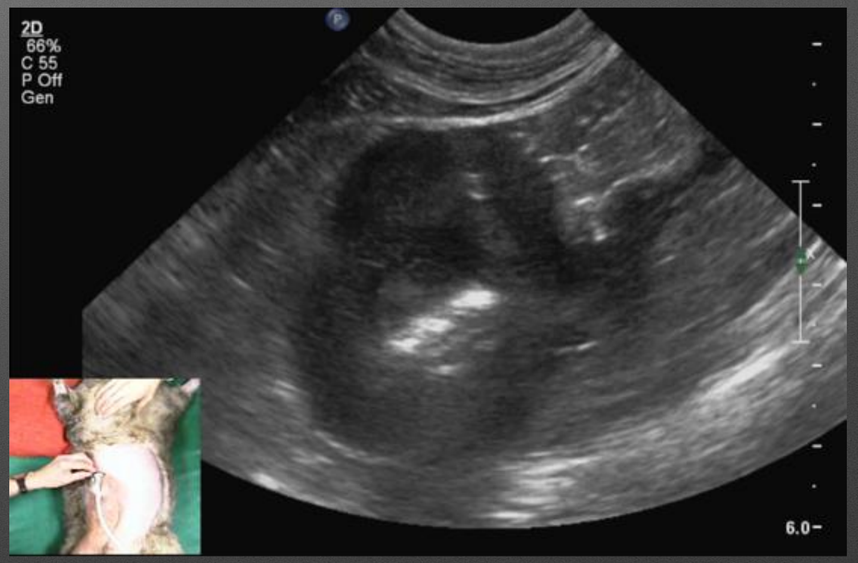
Pythiosis is a chronic pyogranulomatous infection of the gastrointestinal tract or skin caused by the water borne pathogen *Pythium insidiosum*. The ultrasonographic features of nine dogs with gastrointestinal pythiosis are reported. The stomach, duodenum, jejunum or colon were affected. All dogs had thickening of the gastrointestinal wall and areas with obliteration of the normal layered appearance. In one dog an eccentric mass was found arising from the serosal surface of the wall of the colon with mild diffuse wall thickening. Regional lymph node enlargement was seen in seven of the nine dogs. One dog had invasion of the pancreas and signs compatible with extrahepatic biliary obstruction. When compared to previous reports of gastrointestinal neoplasia, the features of wall thickening, loss of layering and regional lymphadenopathy are not considered specific for gastrointestinal pythiosis. Histological examination of tissue specimens is required for diagnosis. *Veterinary Radiology & Ultrasound, Vol. 41, No. 3, 2000, pp 273–277.*

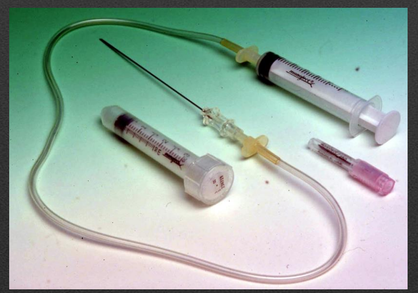
Importance of Sampling

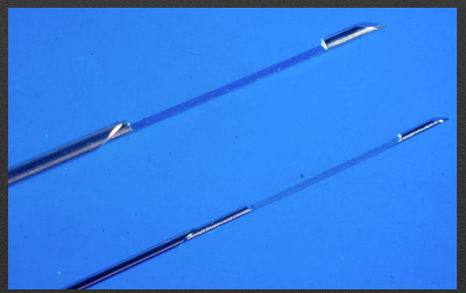
- Fine needle aspiration
- Core biopsy









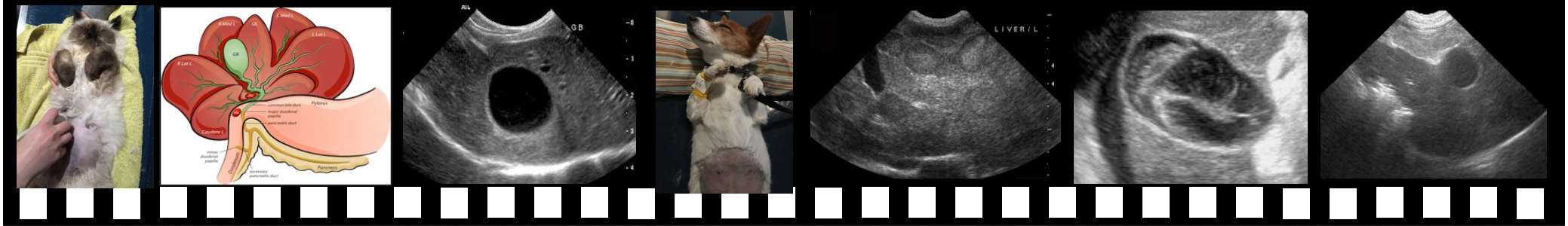


Take home message…

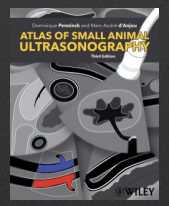
- Signalment, clinical history
- Geography
- Morphology of lesion(s), especially mixed/hyperechogenicity
- Nodules and masses are not all tumors!

Questions?

Exploring the hepatobiliary system



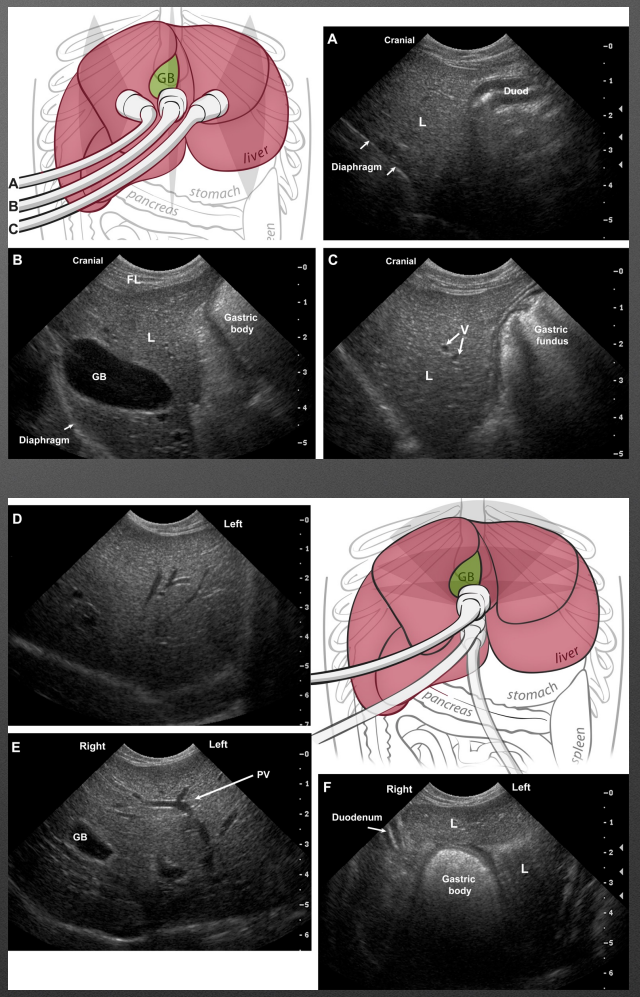
Dominique Penninck, DVM, PhD, DACVR, DECVDI
Professor, Diagnostic Imaging
www.smallanimalultrasonography.com
Atlas of Small Animal Ultrasonography

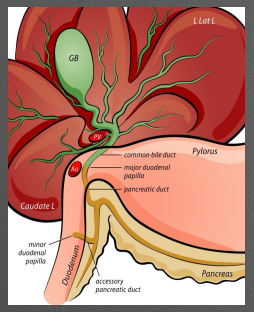


COMMON INDICATIONS:

- ✓ Hepatomegaly/cranial abdominal mass
- ✓ Icterus/abnormal liver profile
- ✓ Search for vascular anomalies
- ✓ Search for metastases
- ✓ Fever of unknown origin
- ✓ Assessment of diaphragmatic integrity
- ✓ Treatment monitoring
- ✓ Interventional procedure

Scanning the liver in a dog



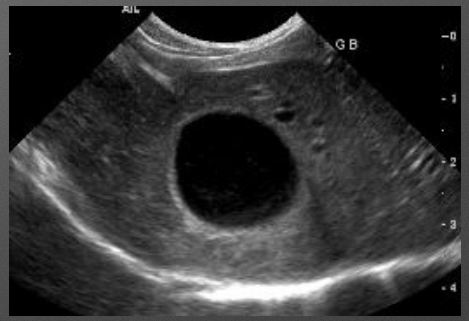


Normal Biliary Tree: Dog

GB between quadrate and right medial lobes

GB wall <1mm—volume: variable

CBD occasionally visible (up to~ 4 mm)

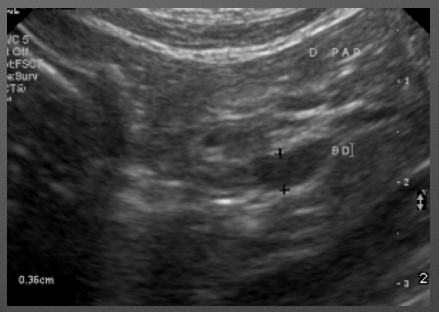


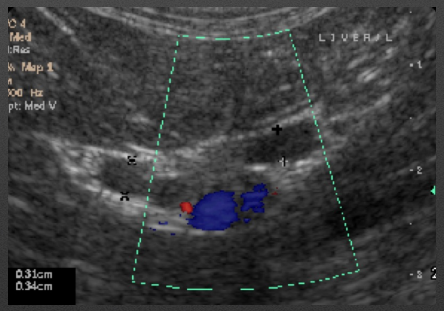
Scanning the liver in a cat

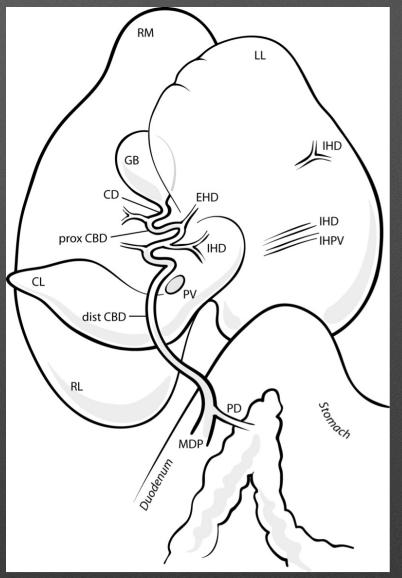
Normal Biliary Tree: Cat

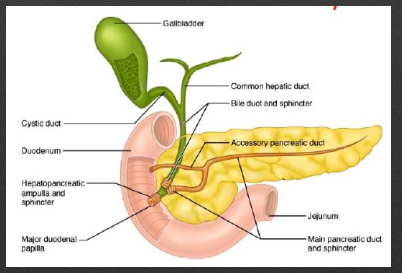
GB in fissure of right medial lobe

GB wall <1 mm—GB volume <5ml
CBD: 4 mm



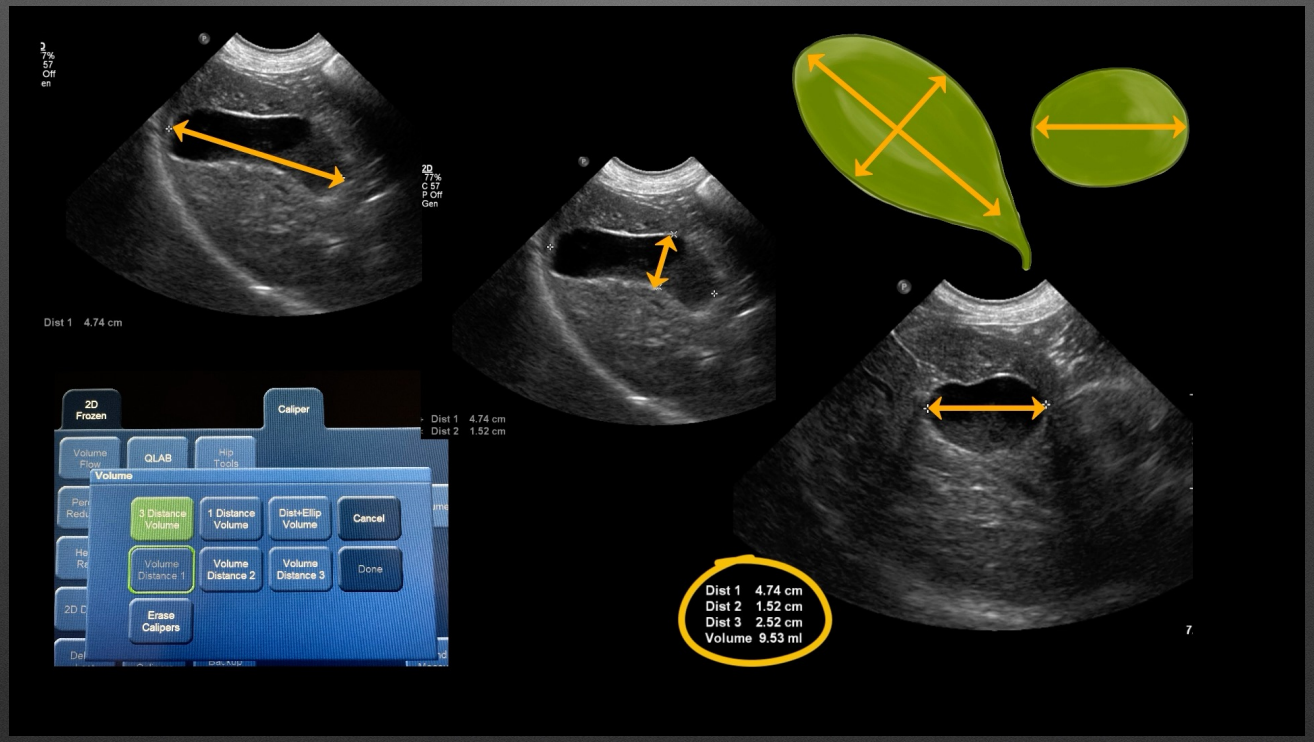






Biliary Tree: Volume

GB wall <1 mm—GB volume <5ml
CBD: 4 mm



GB Content

Sludge: Incidental finding in dogs? Cats?

*Delayed GB emptying (Tsukagoshi et al. 2012)

*GB sludge in cats is strongly predictive of increased liver enzymes and total bilirubin (Harran et al. 2011) but it may also be encountered without evidence of biliary disease

Journal of Veterinary Internal Medicine

Open Access

Standard Article

J Vet Intern Med 2017

Association between Gallbladder Ultrasound Findings and Bacterial Culture of Bile in 70 Cats and 202 Dogs

R. Policelli Smith, J.L. Gookin, W. Smolski, M.F. Di Cicco, M. Correa, and G.S. Seiler

Background: Bacterial cholecystitis often is diagnosed by combination of gallbladder ultrasound (US) findings and positive results of bile culture. The value of gallbladder US in determining the likelihood of bile bacterial infection in cats and dogs with suspected biliary disease is unknown.

Hypothesis/Objectives: To determine the value of gallbladder US in predicting bile bacterial culture results, identify most common bacterial isolates from bile, and describe complications after cholecystocentesis in cats and dogs with suspected hepatobiliary disease.

Animals: Cats (70) and dogs (202) that underwent an abdominal US and submission of bile for culture were included in the study.

Methods: A cross-sectional study design was used to determine the association of gallbladder US abnormalities and the results of bile cultures, and complications of cholecystocentesis.

Results: Abnormal gallbladder US had high sensitivity (96%) but low specificity (49%) in cats with positive and negative results of bile bacterial culture, respectively. Cats with normal gallbladder US findings were unlikely to have positive bile bacterial culture (negative predictive value of 96%). Gallbladder US had lower sensitivity (81%), specificity (31%), positive predictive value (20%), and negative predictive value (88%) in dogs. The most common bacterial isolates were of enteric origin, the prevalence being higher in cats. Incidence of complications after cholecystocentesis was 3.4%.

Conclusions and clinical importance: Gallbladder US has a high negative predictive value for bile culture results in cats. This modality is less predictive of infection in dogs. Percutaneous US-guided cholecystocentesis has a low complication rate.

Key words: Bile culture; Biliary; Cholecystocentesis; Ultrasonography.

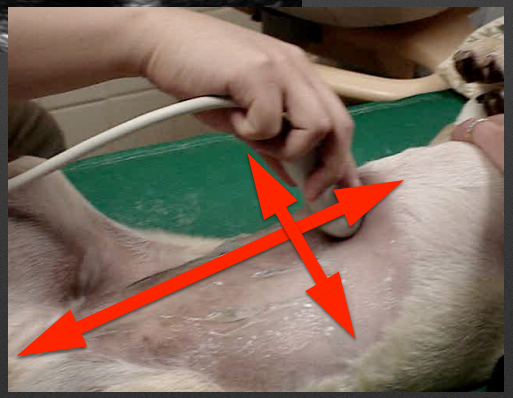
GB Wall Thickening & Echogenicity

- Cholecystitis
- Mucosal hyperplasia
- Wall edema

US features

- Size
- Shape, margins
- Echogenicity and echotexture
- Focal versus diffuse changes
- Focal lesion(s): location, number
- Surrounding structures

Liver size: subjective assessment

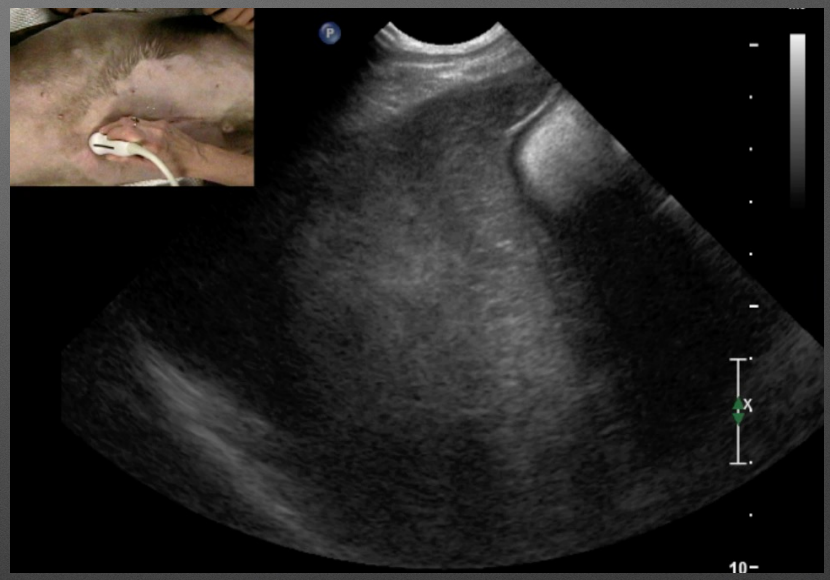


Hepatomegaly

- Lipidosis
- Amyloidosis
- Hepatitis/cholangiohepatitis
- Passive congestion
- Round cell tumors
- Hepatocellular carcinoma

Microhepatia

- Portosystemic shunts
- Microvascular dysplasia
- Cirrhosis/fibrosis



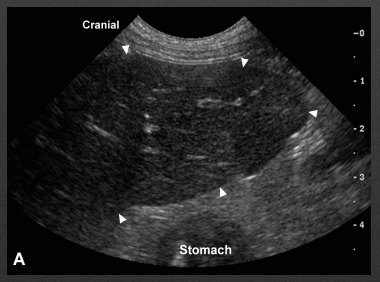
10-year-old CM Weimeraner presented for acute vomiting, diarrhea, icterus, progressive weight loss

	Anechoic	Hypoechoic	Hyperechoic	Mixed
Diffuse	NA	Lymphoma Leukemia Amyloidosis Passive congestion Hepatitis (acute) Histoplasmosis	Lipidosis Fibrosis Steroid hepatopathy Diabetes Mellitus (fat) Lymphoma Mast cell tumor Hepatitis chronic	Diffuse neoplasia Hepatocutaneous syndrome cirrhosis and regenerative nodules
Focal	Cyst Hematoma Abscess Necrosis Cystic tumor Cystic met	Metastasis Tumor Lymphoma Histiocystic sarcoma Hepatitis Nodular hyperplasia Abscess Necrosis Complex cyst Hematoma	Nodular hyperplasia Steroid hepatopathy Fat/Mineral Gas Abscess	Nodular hyperplasia Tumor/met Abscess Hematoma

Diffuse changes:

Hypoechoic

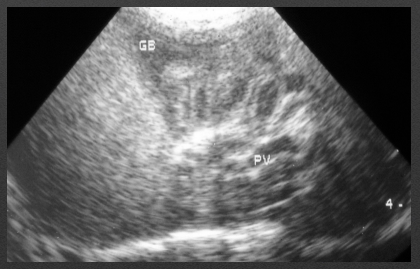
- Passive congestion
- Hepatitis (acute)
- Histoplasmosis
- Tumor (LMA, CA)
- Leukemia
- Amyloidosis



Lymphoma

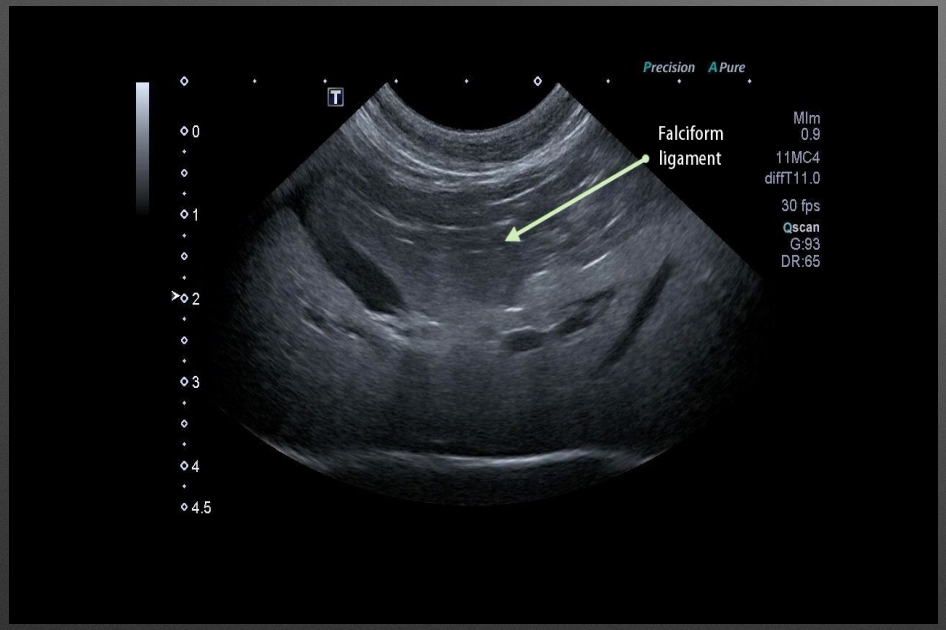
Hyperechoic

- Lipidosis/fat infiltration
- Fibrosis/cirrhosis
- Metabolic hepatopathy
- Diabetes mellitus
- Lymphoma, MCT
- Chronic hepatitis



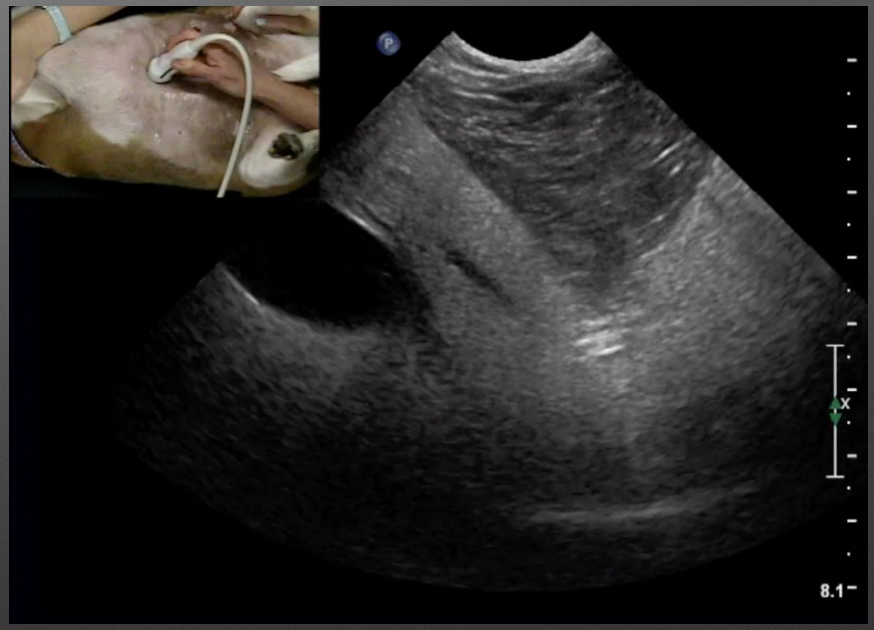
Suppurative cholangiohepatitis-cat

Lipidosis



Metabolic Hepatopathy

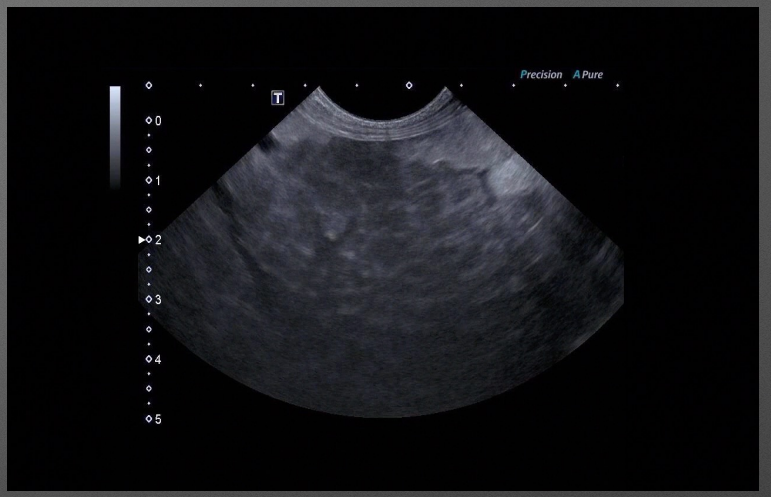
(Cushing's disease)

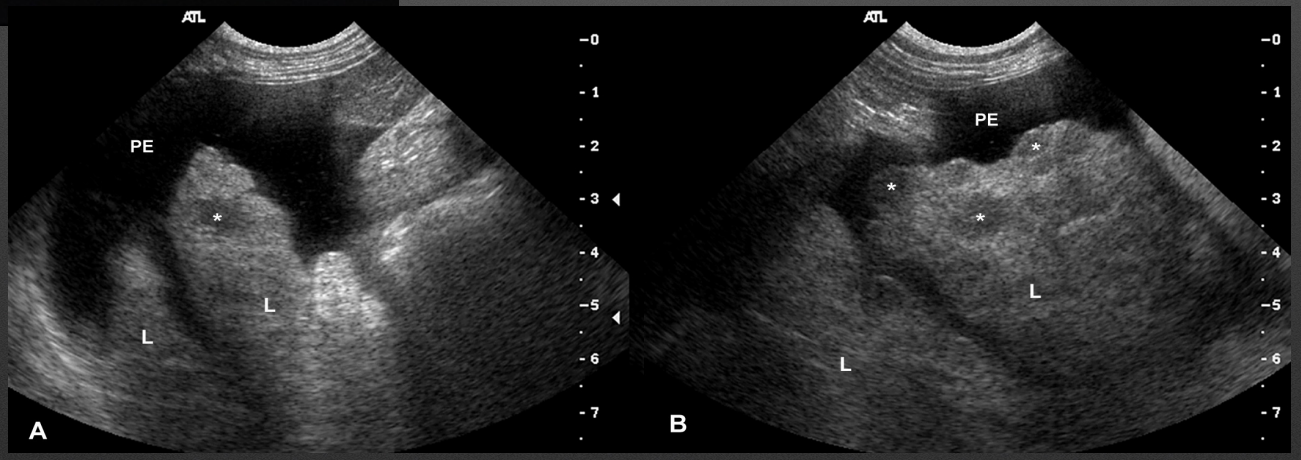


From the Atlas of Small Animal Ultrasonography

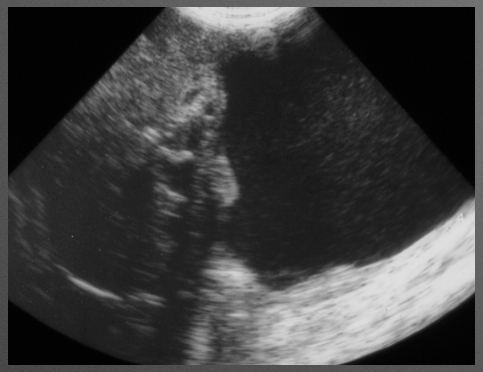
Cirrhosis

- Small, nodular liver
- Regenerative nodules

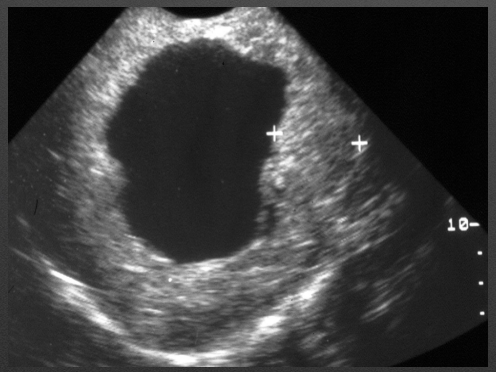




FOCAL changes: Anechoic



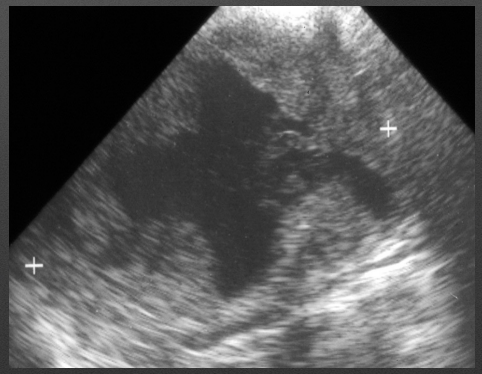
Bile duct cyst (cat)



Bile duct cyst (cat)

- Cyst
- Hematoma
- Abscess
- Necrosis
- Cystic tumor/mets

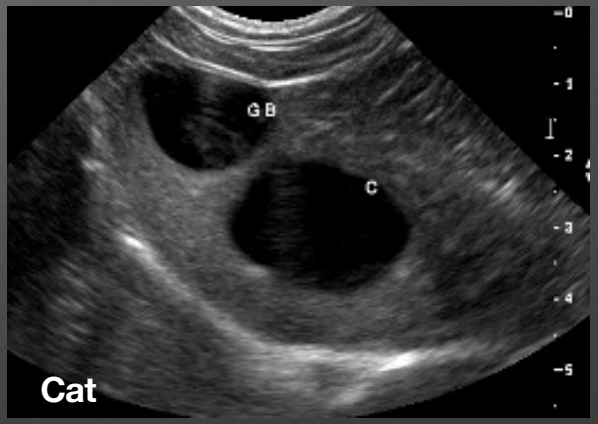
Hepatic cyst



Met osteosarcoma (dog)

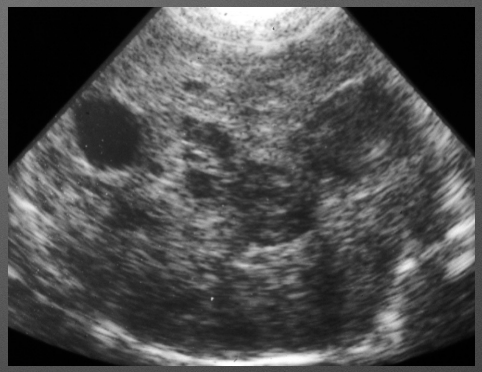
Hepatic cysts

- Anechoic content
- Enhancement artifact
- Thin (or no) wall
- Rounded to oval shaped



FOCAL changes: hypoechoic

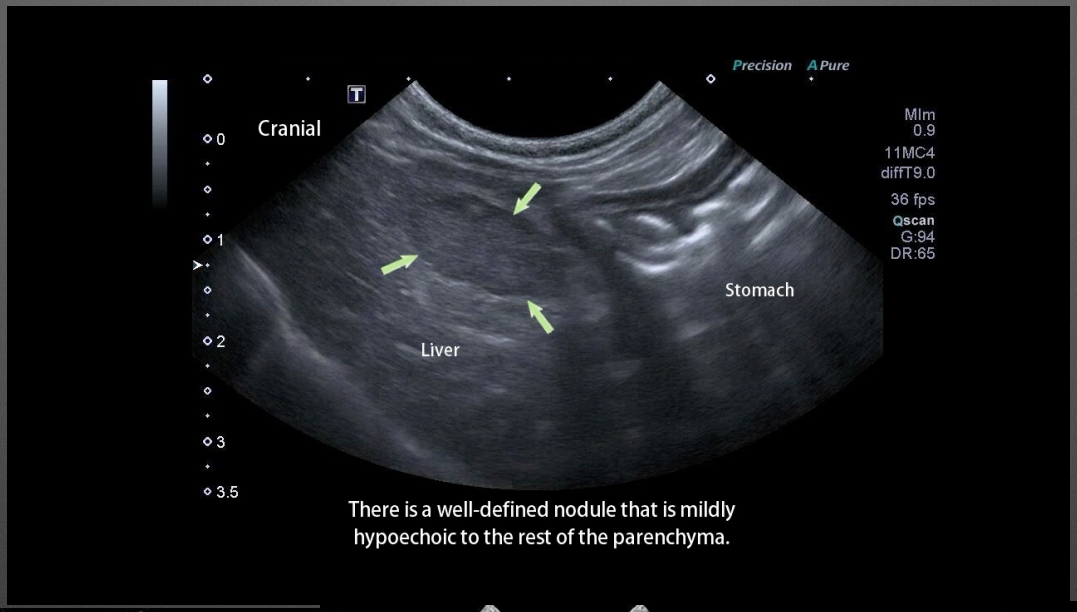
- Tumor (LMA, MCT, HS)
- Metastasis
- Hepatitis
- Nodular hyperplasia
- Abscess
- Necrosis
- Complex cyst
- Hematoma
- Infarction

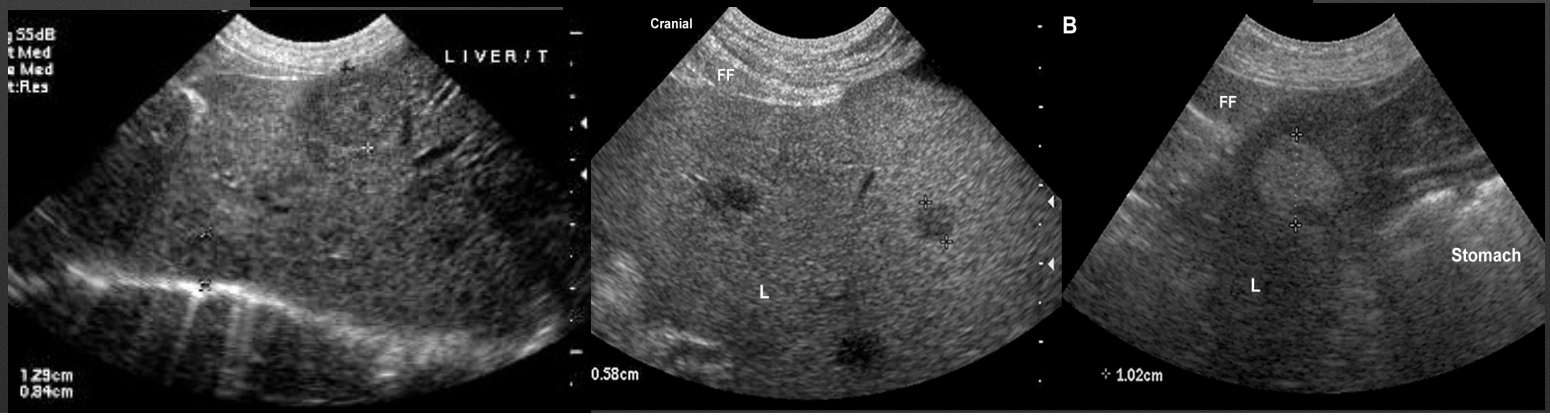


Abscess

- Hypoechoic to anechoic cavity, or mixed
- Gas, not always
- Inconsistent wall
- Differential diagnosis: hematoma, tumor

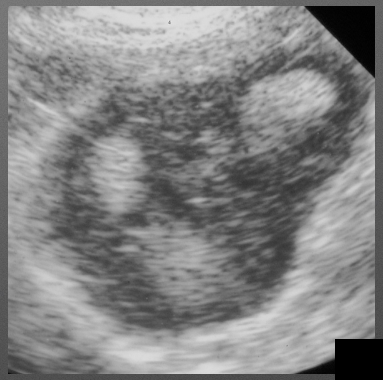
Nodular hyperplasia



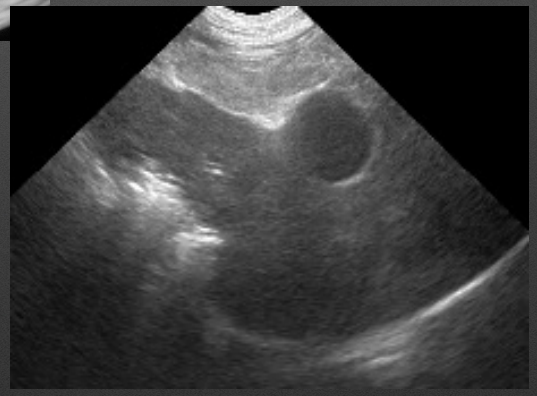


Focal changes: hyperechoic

- Nodular hyperplasia
- Steroid/metabolic hepatopathy
- Fat/mineral
- Gas (reverberation/dirty shadowing)
- Abscess
- (hemoclip!)



Nodular hyperplasia

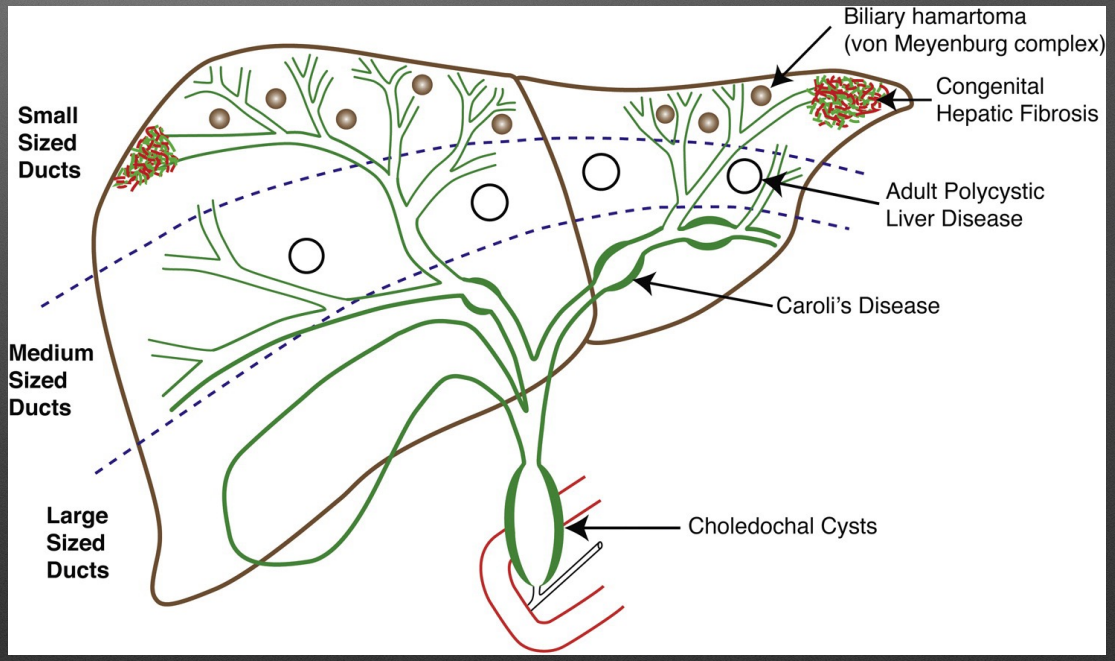


Anaerobic infection

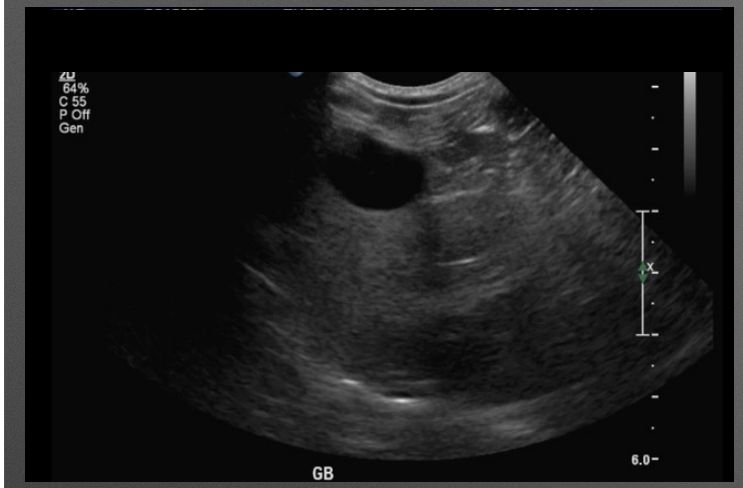
Congenital Anomalies

Ductal plate anomalies

- (GB agenesis)
- GB duplication
- Choledochal cyst
- Caroli disease



N. Venkatanarasimha et al. / Clinical Radiology 66 (2011) 1086e1093

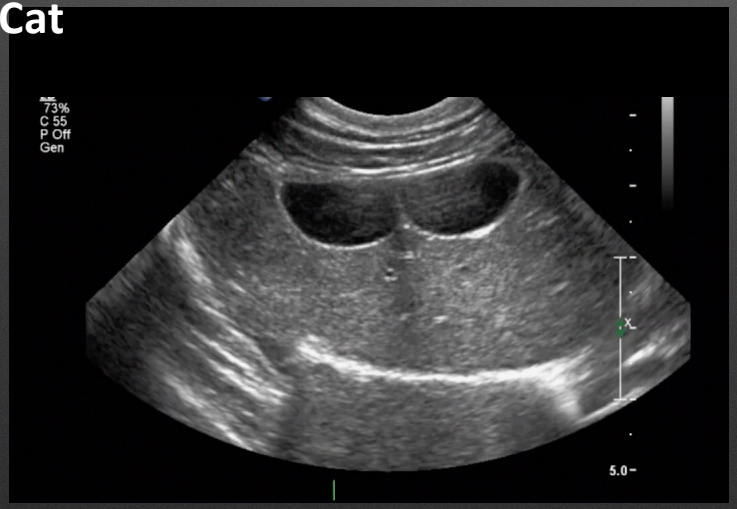


GB Duplication

2 separate funduses and bodies
Single neck,cystic duct, and bile duct
“V” or valentine heart shaped GB

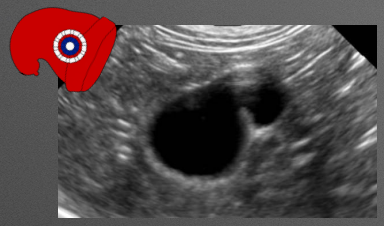
Incidental finding?

Cat

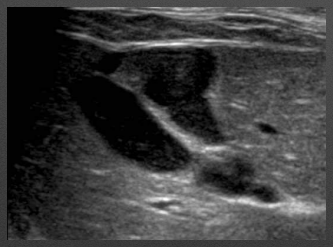


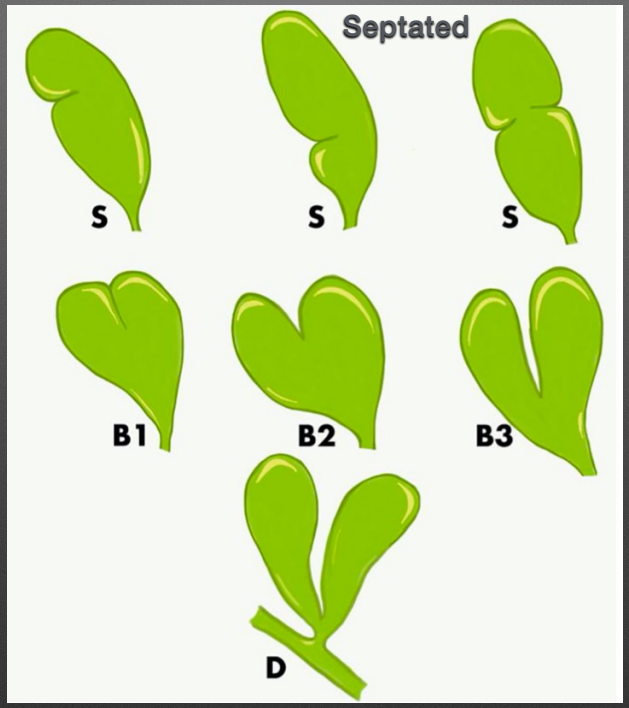
Dog

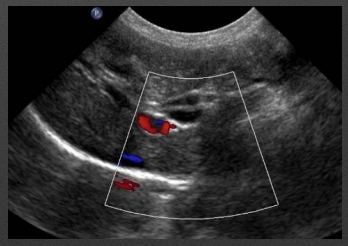
GB Shape



Phrygian cap







Ultrasonographic prevalence and proposed morphologic classification of bilobed gallbladder in cats

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SAGE

Heather N Spain[1], Dominique G Penninck[2] and Michael Thelen[3]

Abstract

Objectives Morphologic anomalies of the feline gallbladder (GB) have been previously reported in the literature. These morphologic variants are frequently encountered on routine abdominal ultrasound examination. The aim of this study was to provide an ultrasonographic classification system of these variants and document the overall incidence in the feline population.

Methods A prospective, descriptive study was undertaken; cats that had an abdominal ultrasound examination that included at least one sagittal and transverse plane image of the GB were included. GB shape was evaluated and categorized based on a classification scheme of morphologic variants modified from the human literature. Septated (S), bilobed (B1, B2, B3), duplex (D) and complex (C) categories were described.

Results Of 516 cats included in the study, 389 had normal GB morphology, while 127 had anomalous GB morphology. The overall incidence rate of anomalous GB morphology was 24.61%. When examined by morphologic type, the septated (S) morphology had an incidence of 9.69%. A bilobed (B) morphology was the most commonly observed classification; incidence was 14.35% within our population; incidence of B1, B2 and B3 subtypes were 2.91%, 6.98% and 4.46%, respectively. Duplex GBs only made up 0.39% of the total population. The incidence of complex (C) morphologies was 0.19%.

Conclusions and relevance The incidence of GB morphologic anomalies was higher in our population than previously reported. Identification of these anomalies on routine ultrasound evaluation is common; numerous different morphologies can be identified and a standardized classification scheme is proposed. Complete evaluation of morphology can be challenging, particularly with regard to cystic duct anatomy. Clinical significance is uncertain and future studies are warranted to determine the relationship between morphologic variants and hepatobiliary disease.

Ultrasonographic and clinicopathologic features of segmental dilatations of the common bile duct in four cats

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1–9
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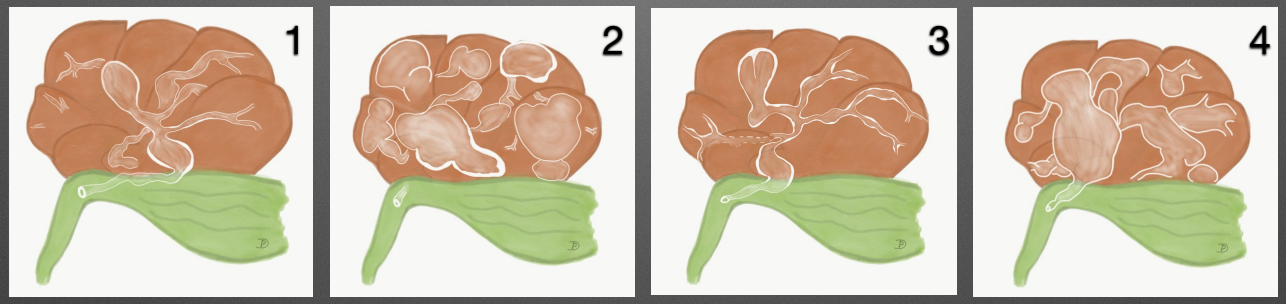
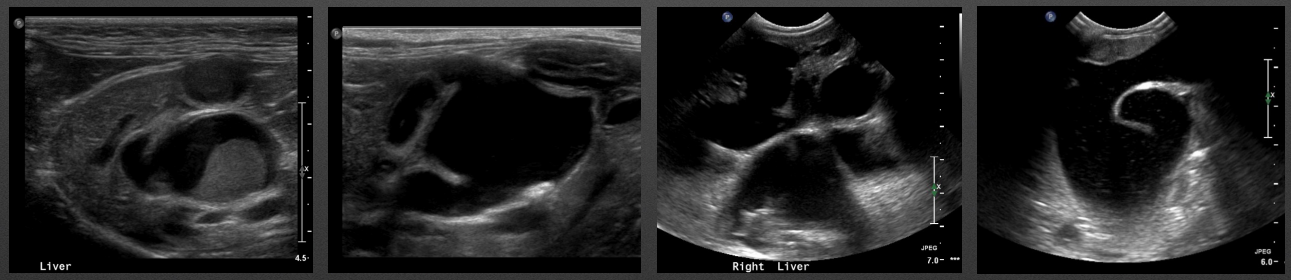
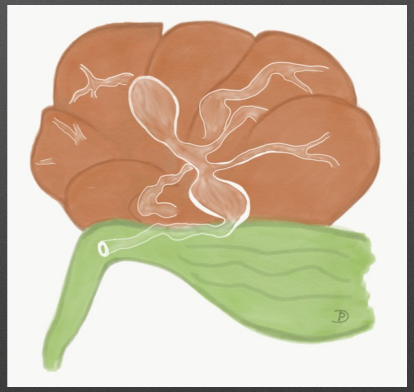
Heather N Spain, Dominique G Penninck, Cynthia RL Webster, Evence Daure and Samuel H Jennings





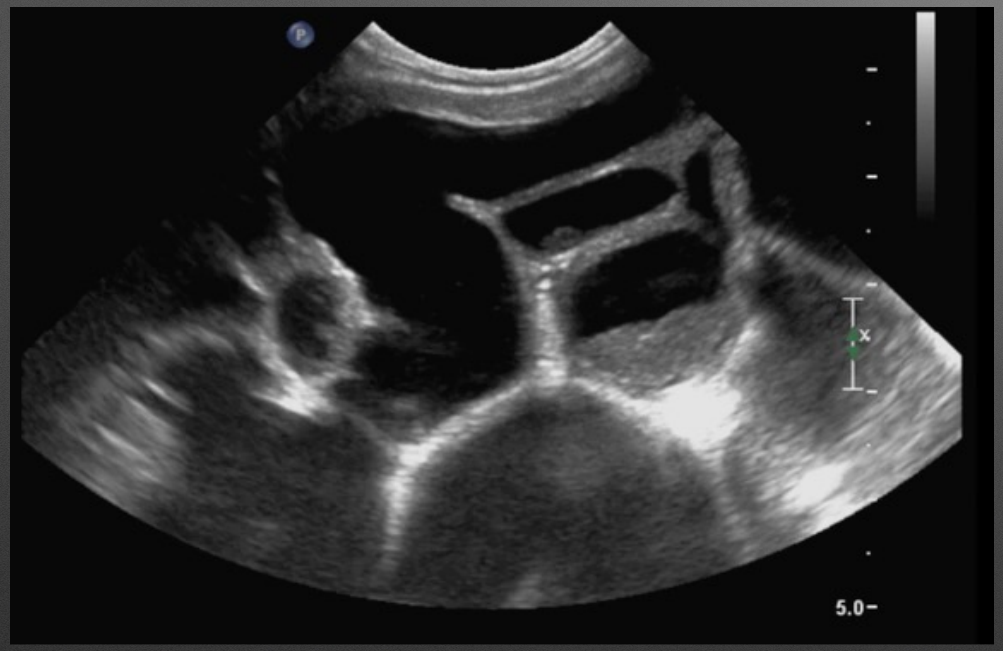
Choledochal cyst

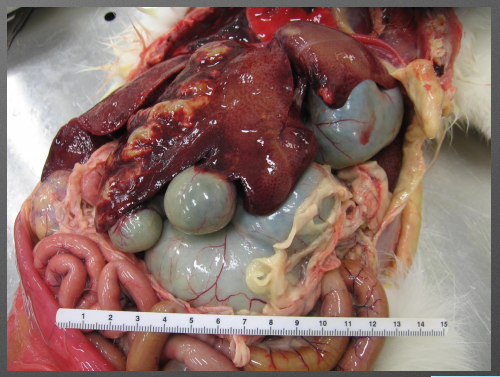
A 6.5-year-old, FS,DSH cat was presented for a history of chronically elevated serum liver enzyme activity. Over the previous 2 years, the cat had multiple episodes of infectious cholangitis, which had cultured positive for Enterococcus, Escheria coli and Corynebacterium

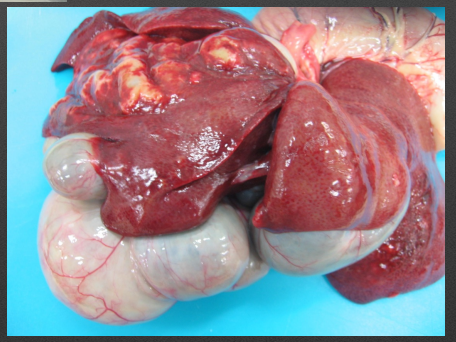


Caroli Disease

5-year-old CM, DSH was presented for lethargy, decreased appetite, and enlarged cranial abdomen. He is mildly icteric (only on pinnae)



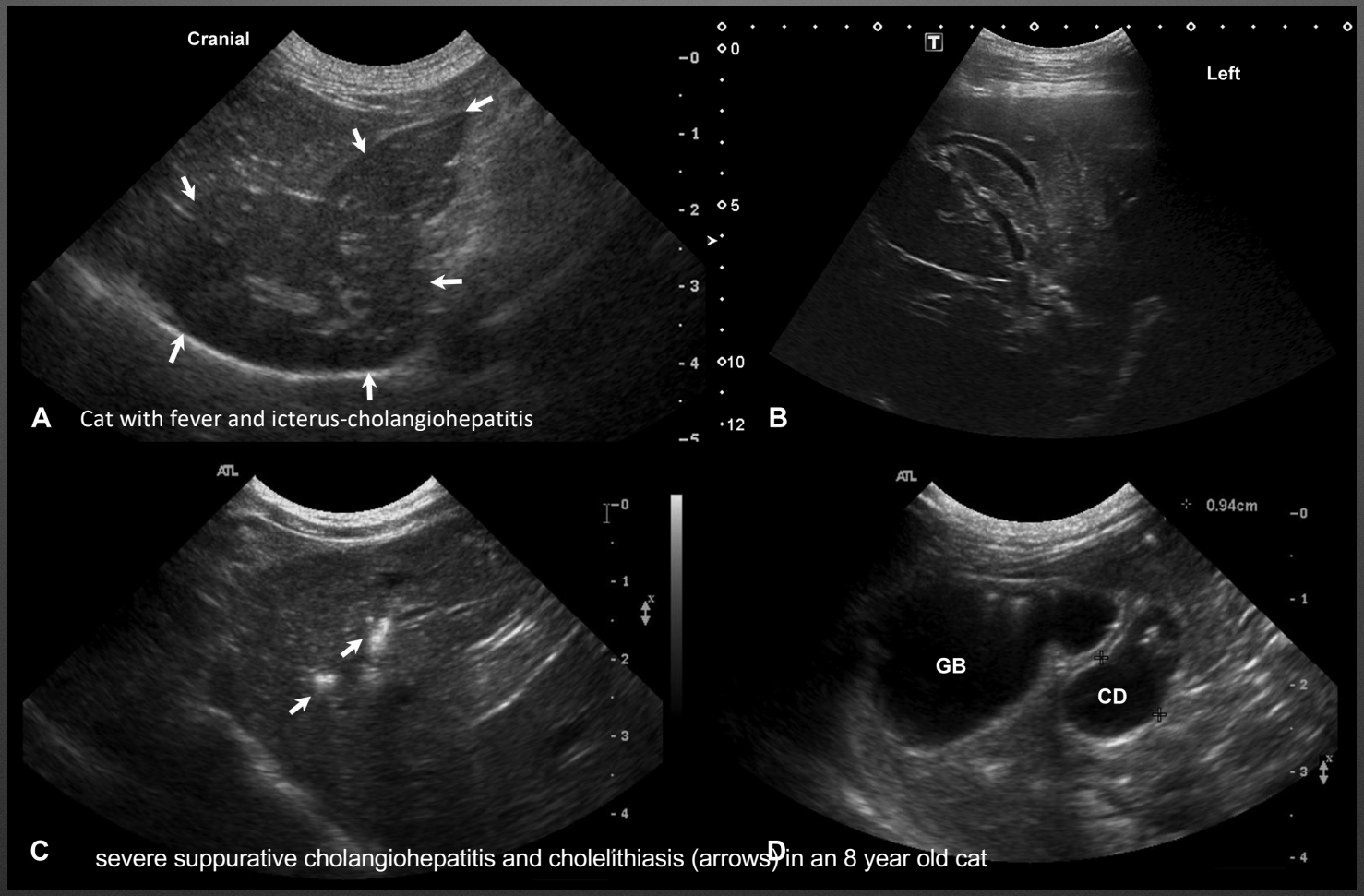




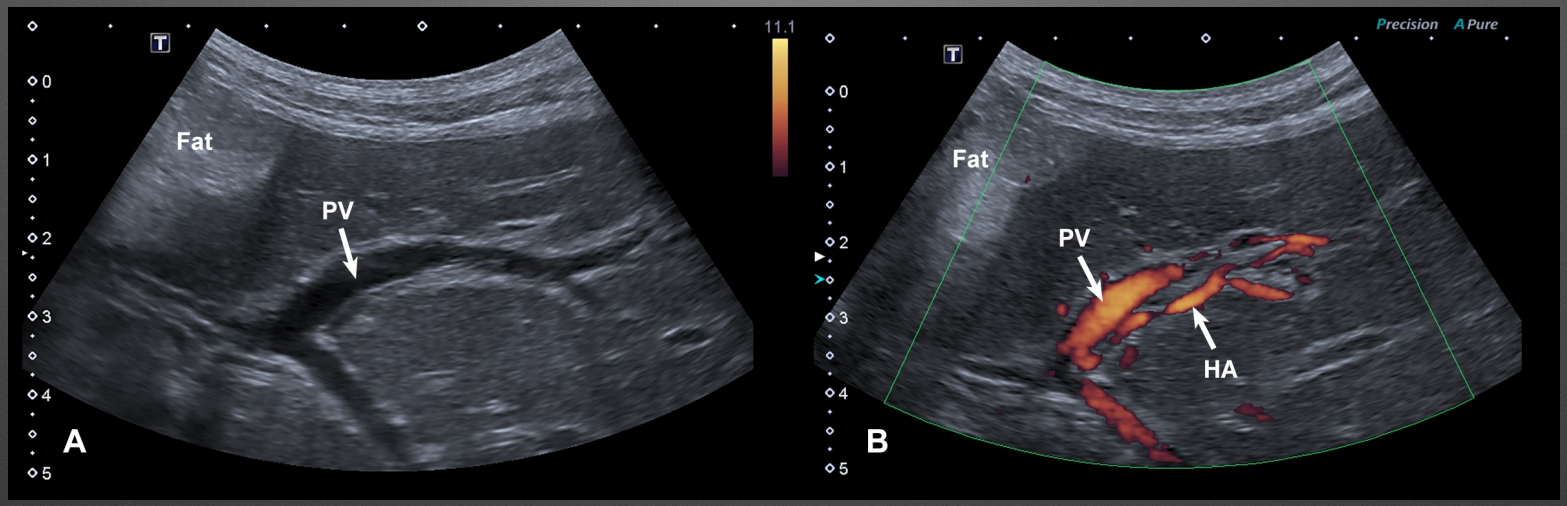
On necropsy, all bile ducts were severely distended.

Liver: severe, diffuse intrahepatic biliary duct dilation (presumed congenital) with marked fibrotic biliary hyperplasia, and moderate cholangitis and cholecystitis.

Inflammatory diseases (cat)



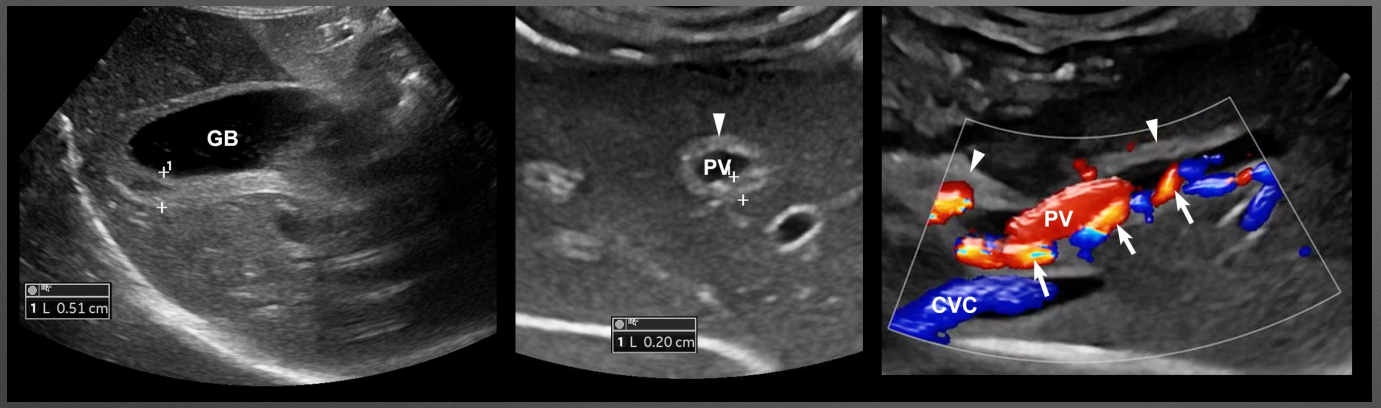
Inflammatory diseases (dog)



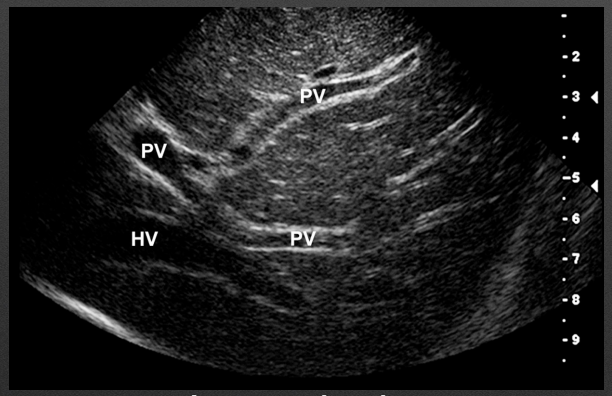
Severe granulomatous cholangiohepatitis in a dog with mildly elevated ALT.

Surgical biopsies revealed severe inflammation primarily involving the portal triads and periportal tissues of unknown etiology (normal culture and copper level).

Suppurative cholangiohepatitis (dog)



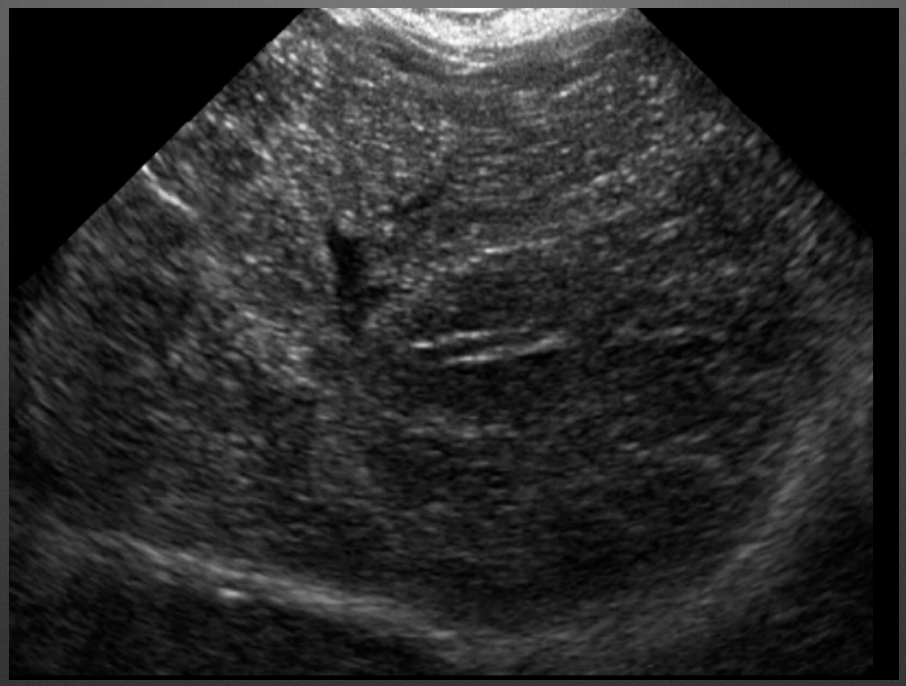
3-year-old Chihuahua with acute suppurative cholangiohepatitis



Leptospirosis

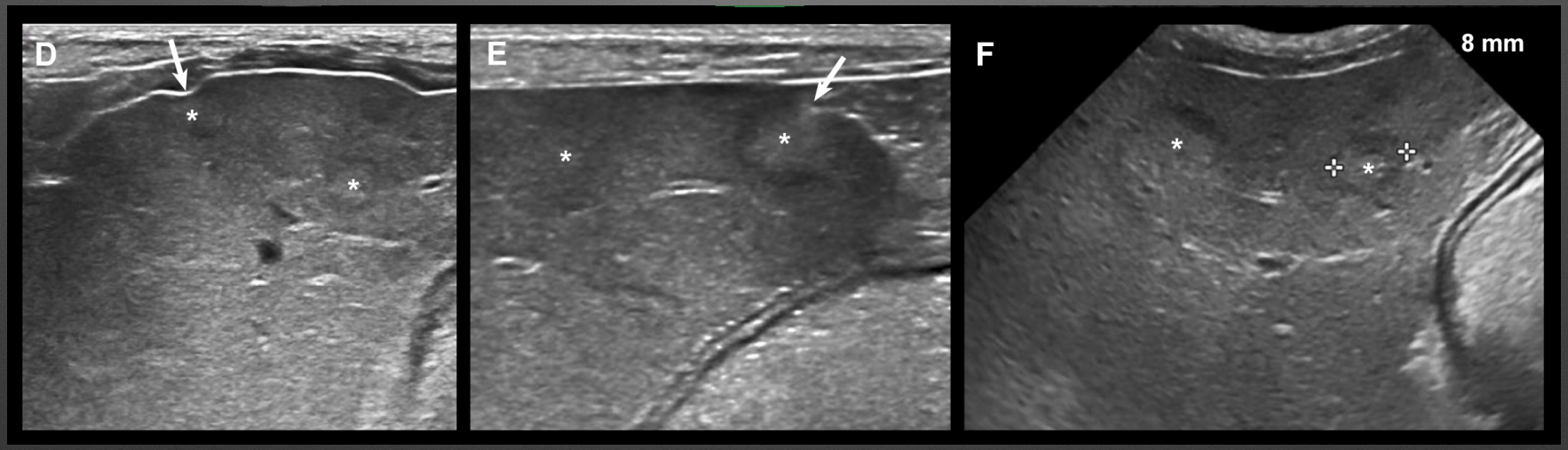
6-year-old Labrador with **Chronic suppurative hepatitis**

Multifocal granulomatous hepatitis & hepatocellular hypertrophy (*Heterobilharzia americana)*



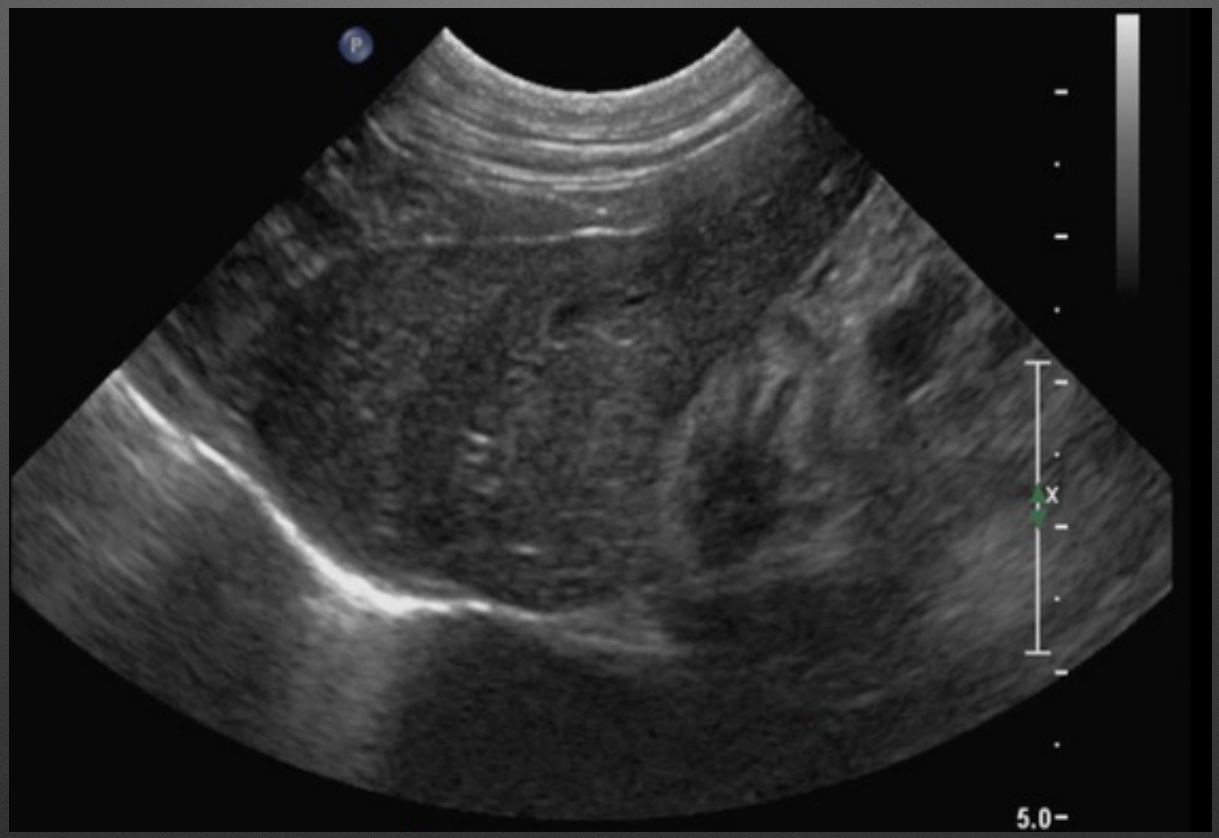
6-year-old Dachshund with increased liver enzyme (routine labwork)

Granulomatous cholangiohepatitis

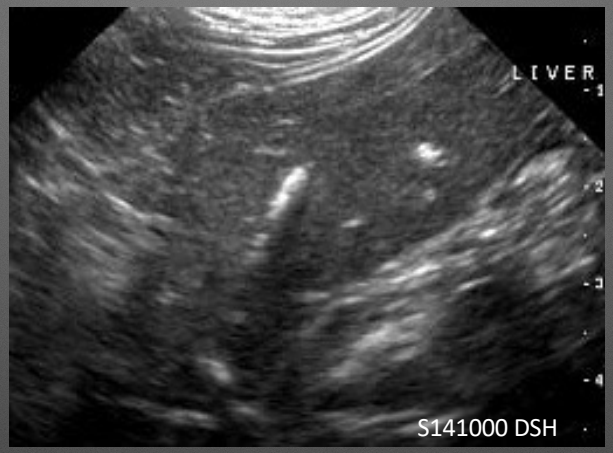


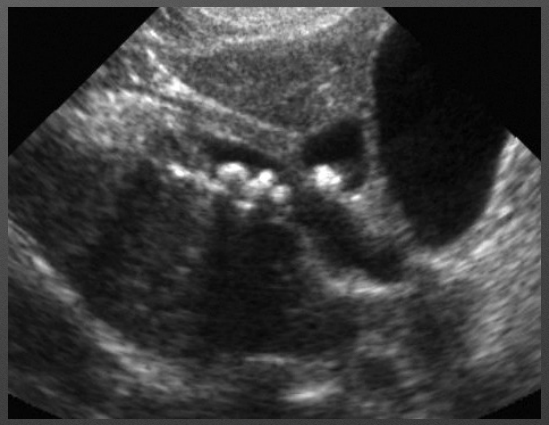
6-year-old dog with severe, coalescing granulomatous hepatitis. Numerous target-like lesions (*) noted in the enlarged hyperechoic liver

Cholecystitis



Biliary Lithiasis



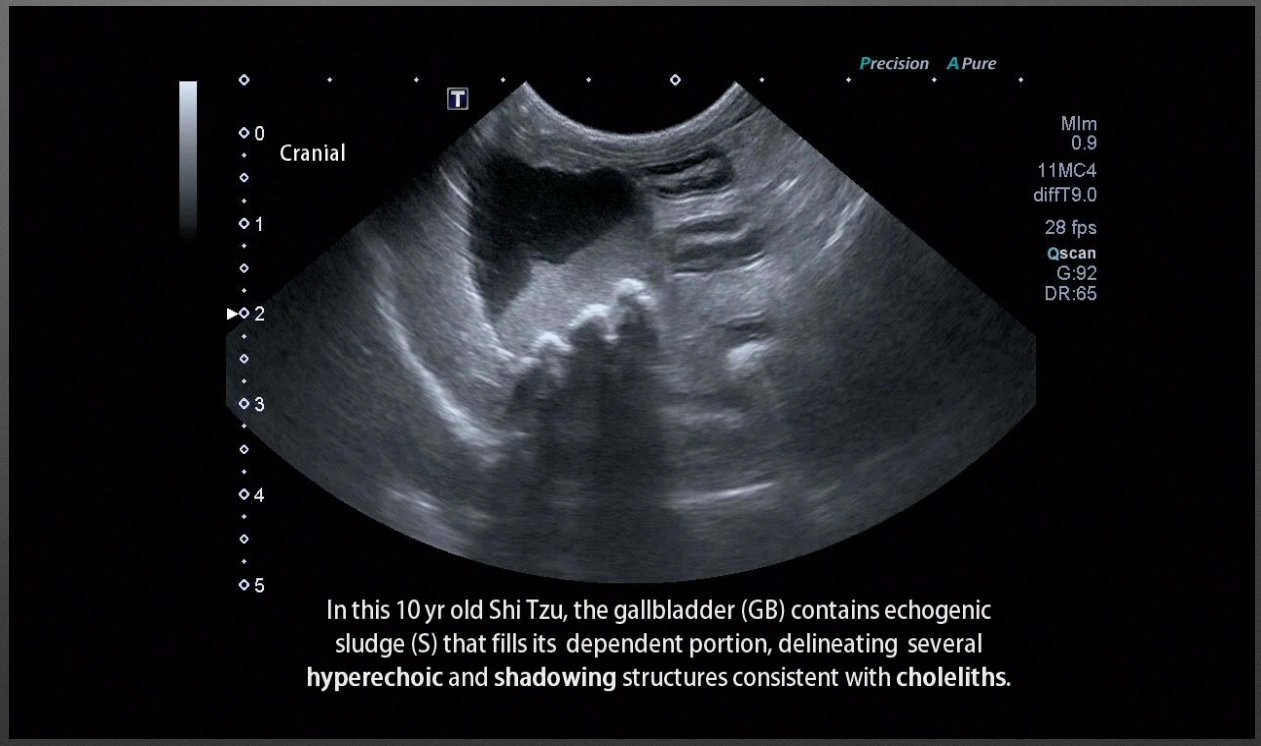


Calculi in GB and biliary tree

Composition: cholesterol, bilirubin, Calcium, magnesium, oxalates

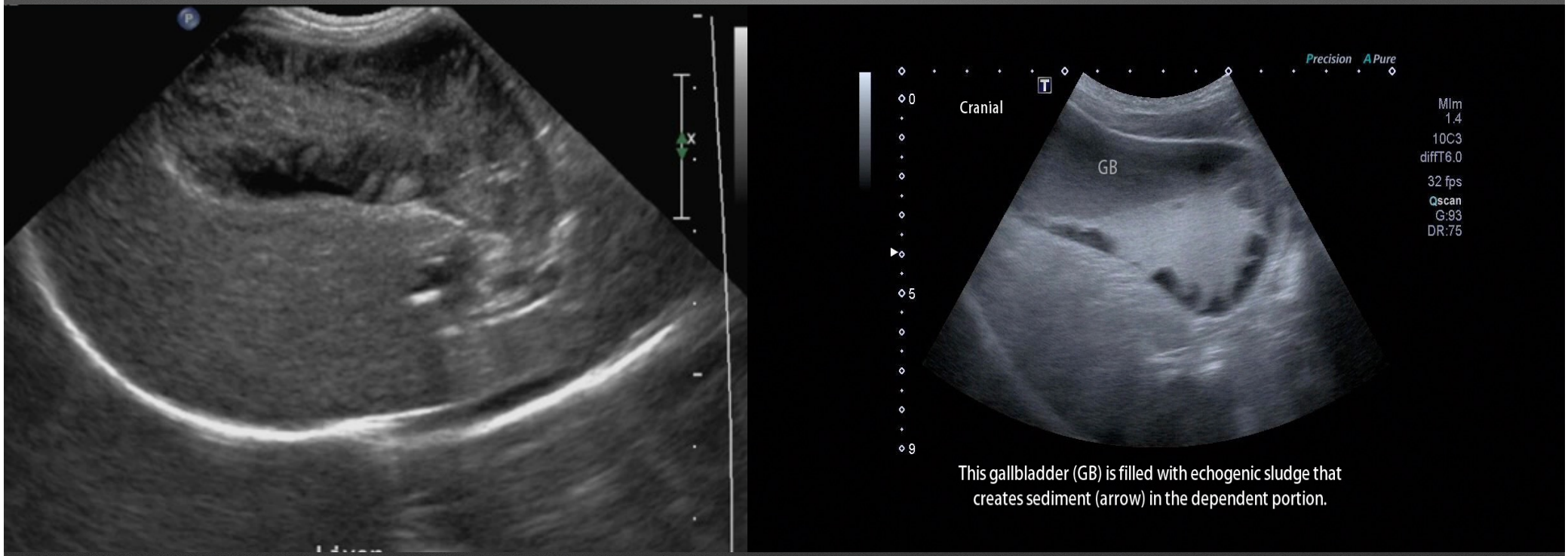
Cholecystolithiasis

- Calculi in the GB and biliary tree
- Composition: cholesterol, bilirubin, calcium, magnesium, oxalates



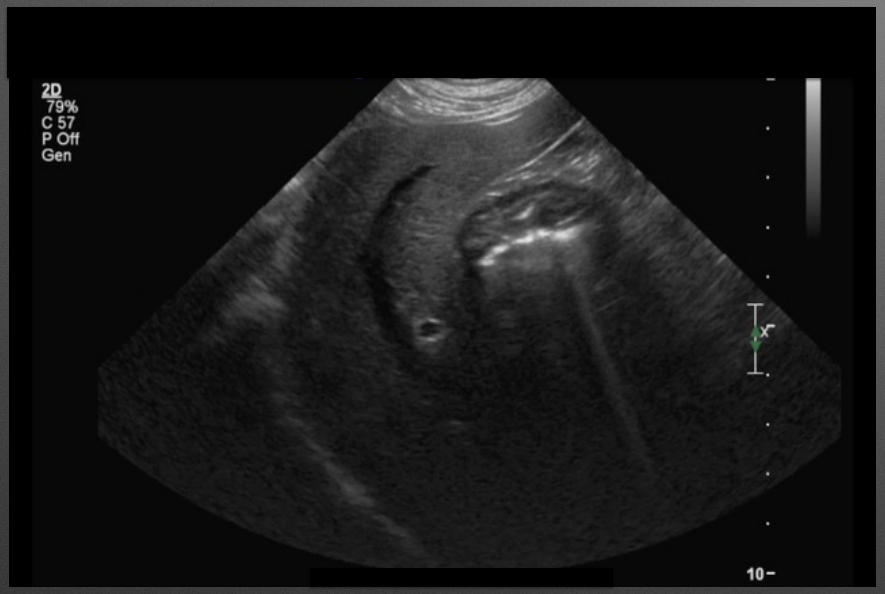
From the Atlas of Small Animal Ultrasonography
Video Dr. D'Anjou

Gallbladder Mucocele

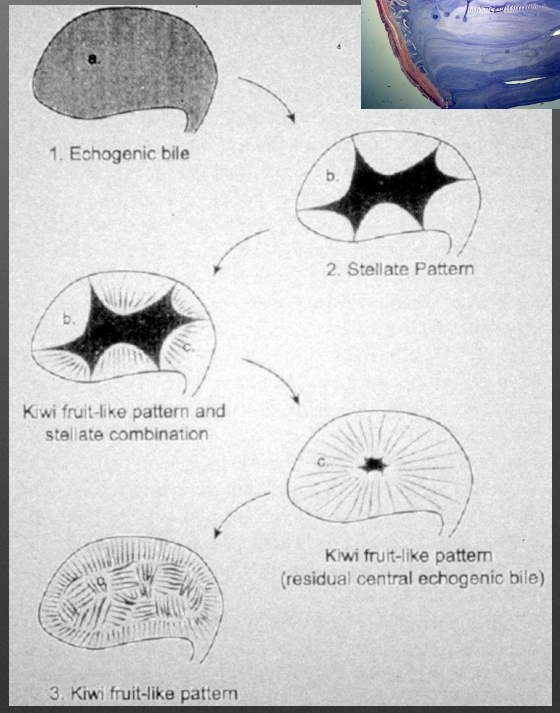


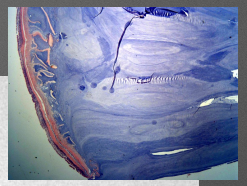
This gallbladder (GB) is filled with echogenic sludge that creates sediment (arrow) in the dependent portion.

Gallbladder Mucocele



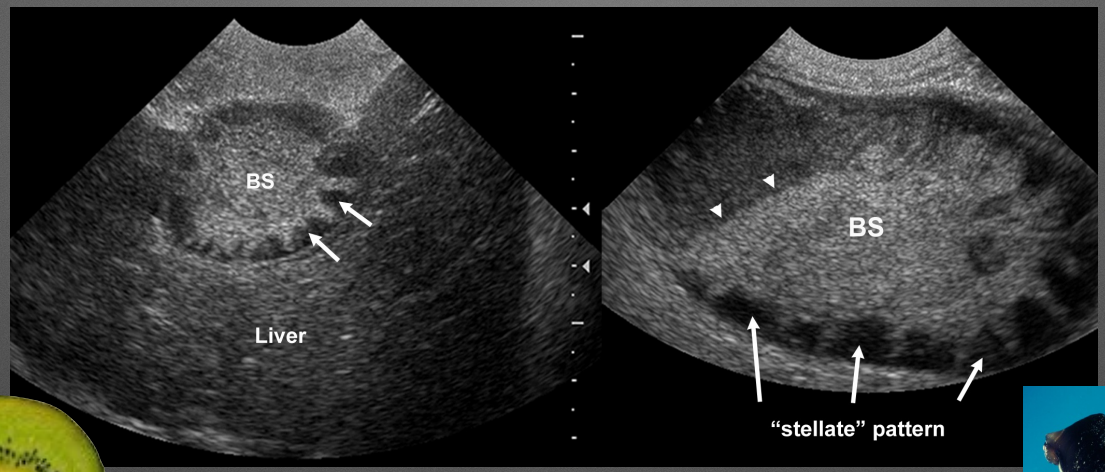
Smaller breeds, older dogs
(Cocker Spaniels)
Vomiting, anorexia, lethargy
Abdominal pain, icterus, hyperthermia
Increased bilirubin and/or SAP, ALT, AST, GGT



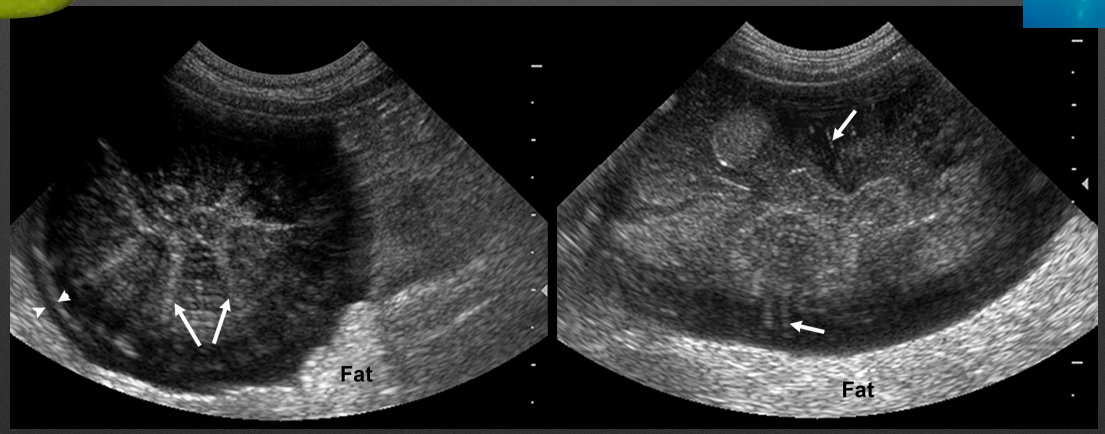


Besso J et al. Veterinary Radiol & Ultrasound 2000
Pike F et al. JAVMA 2004

Gallbladder Mucocele



Kiwi fruit-like pattern

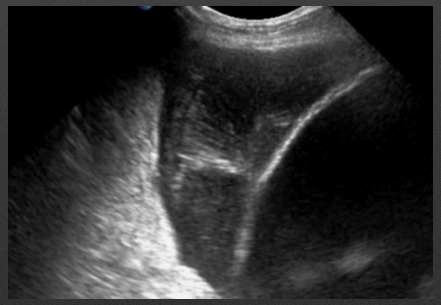


A 6-year-old Cocker Spaniel is presented for icterus, lethargy and is vomiting for the past few days

Ruptured Mucocele

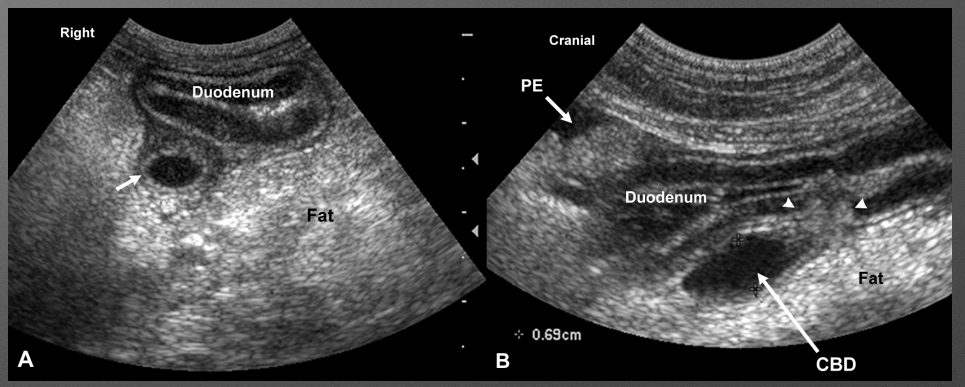
Regional bright fat &
fluid accumulation

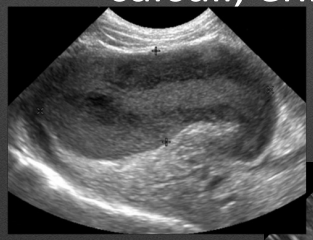
5-year-old Maltese cross was inappetent and vomited bilious fluid

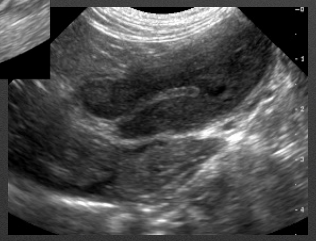


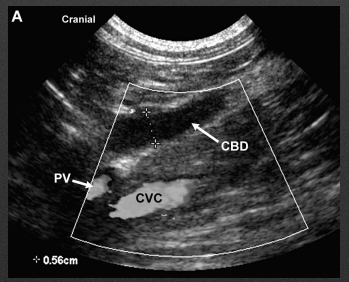
Extrahepatic Biliary Obstruction

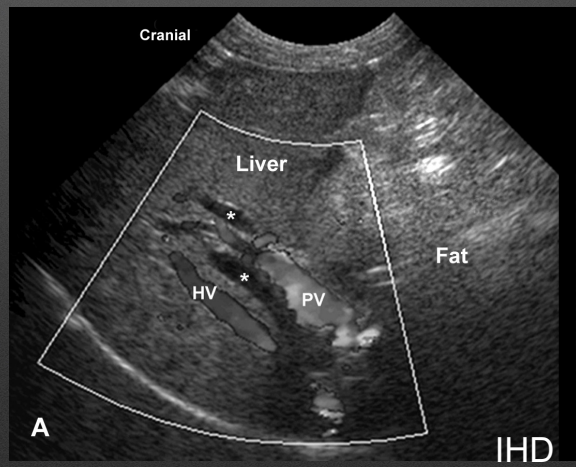
- Gallbladder distension (inconsistent in cats)
- CBD/HD distension
- Origin of obstruction/compression:
  calculi, enlarged pancreas, LNs, mass

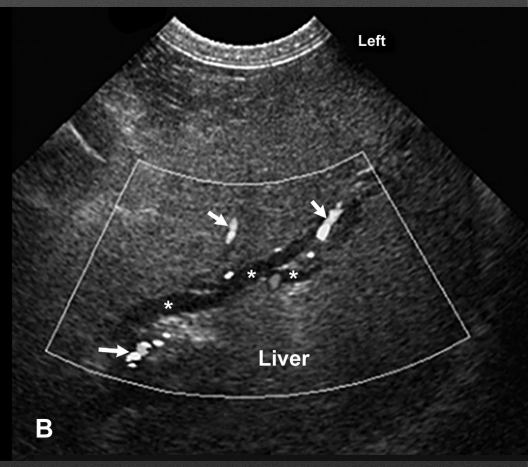




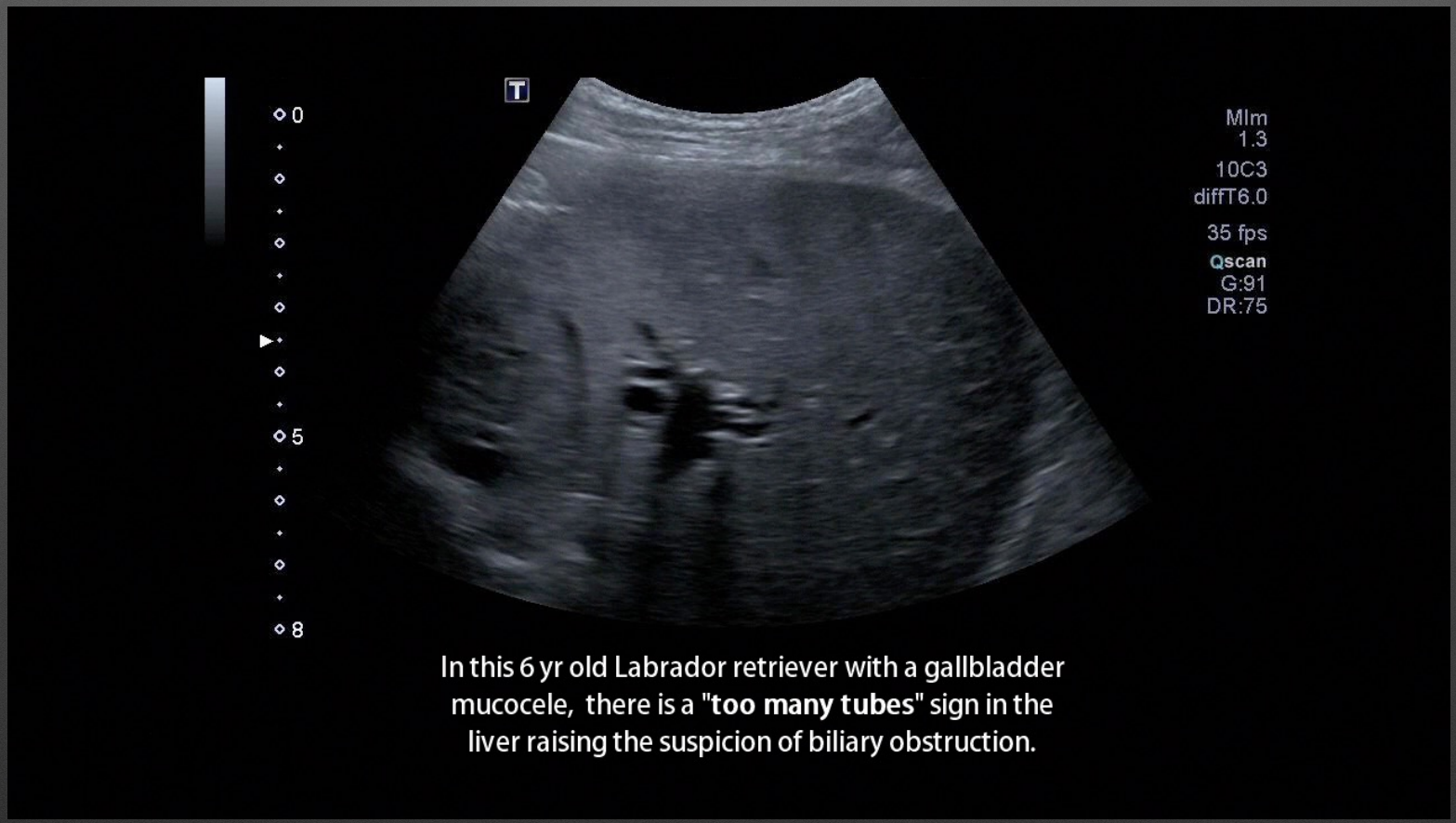








Extrahepatic Biliary Obstruction



From the Atlas of Small Animal Ultrasonography
Video Dr D'Anjou

Extrahepatic Biliary Obstruction

Tumors (12/30)

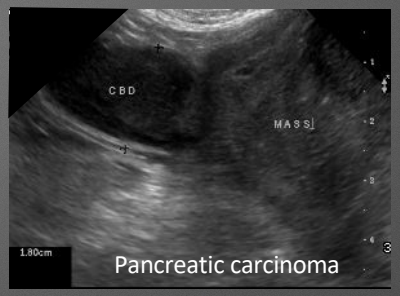
Biliary carcinoma	6/12
Pancreas carcinoma	3/12
Duodenum SCC	1/12
Duodenum lymphoma	1/12
Unclassified panc/bile ca	1/12

Inflammatory diseases (11/30)

Chronic pancreatitis	3/11
Pericholedochitis	3/11
Choledochitis	2/11
Duodenitis	2/11
Pancreatic abscess	1/11

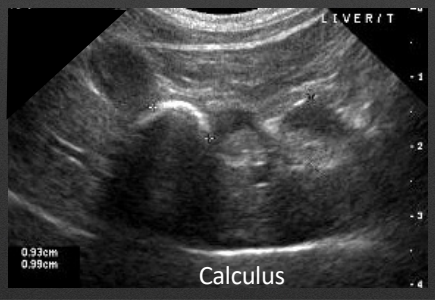
Choleliths (7/30)

Calculus	5/7
Amorphous plugs	2/7



Pancreatic carcinoma

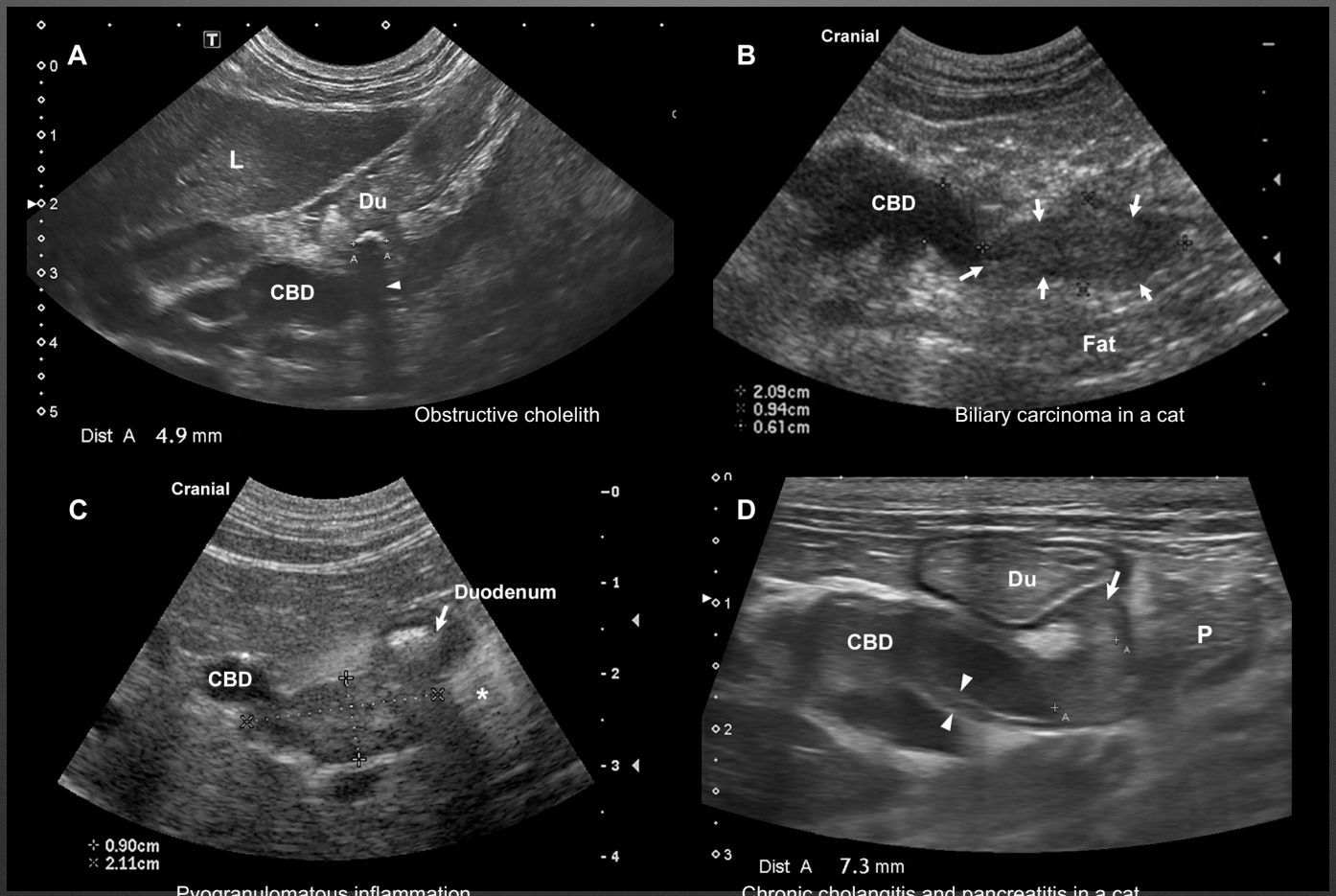
Pancreatic abscess



Calculus

Gaillot et al. Vet Radiol & US, 2007

Extrahepatic Biliary Obstruction



To Remember in cats…

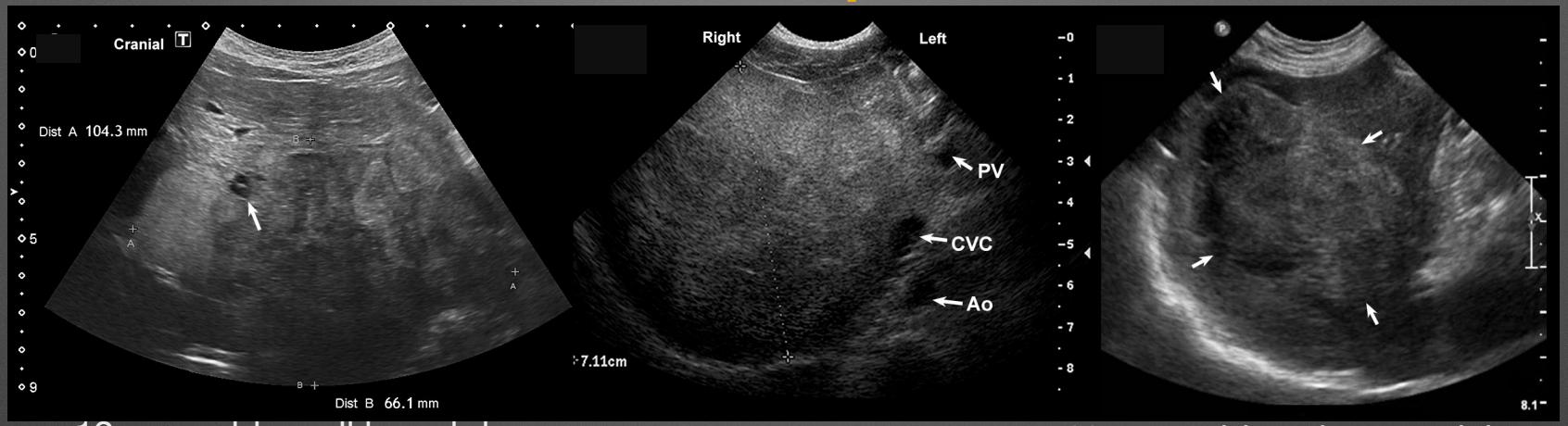
- CBD diameter > 5 mm = strong indicator of EHBO (in pertinent clinical context)
- No difference in CBD diameter between tumor/inflammation/calculi
- GB dilation is not a reliable sign of EHBO
  - 43% of the cats
  - 38%-62% in other studies
- 90 % of the cats had EHD/IHD dilation
- Obstructive choleliths reliably diagnosed 100%
- US does not differentiate reliably tumor from inflammation

Gaillot et al. Vet Radiol & US, 2007

Hepatic tumors

- Single or multifocal hyperechoic masses most likely hepatocellular carcinoma
- Hepatoma and adenoma may have a coarse echotexture nearly isoechoic to the normal liver
- Sarcomas: hemangiosarcoma, myxosarcoma, histiocytic sarcoma
- Lymphoma (round cell)
  - Diffuse, can be hypoechoic or hyperechoic
  - Multifocal, hypoechoic
- Biopsy, biopsy, biopsy !!!

Well-differentiated hepatic carcinoma

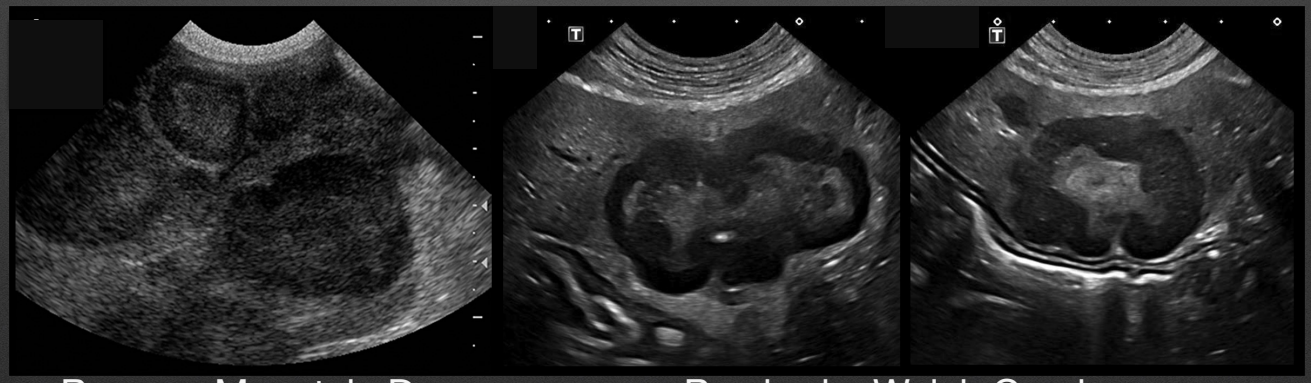


12-year-old small breed dog

Another dog

13-year-old cocker spaniel cross

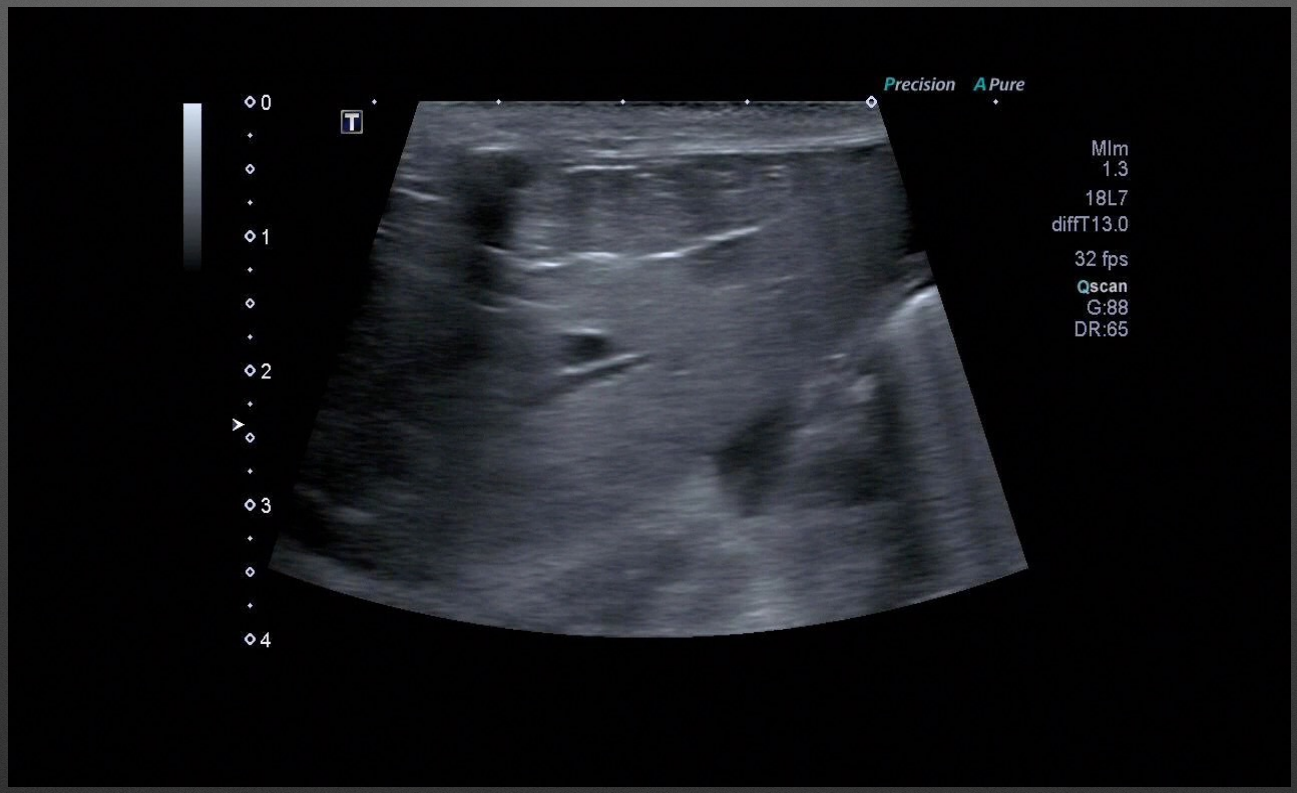
Disseminated histiocytic sarcoma



Bernese Mountain Dog

Pembroke Welch Corgi

Metastases



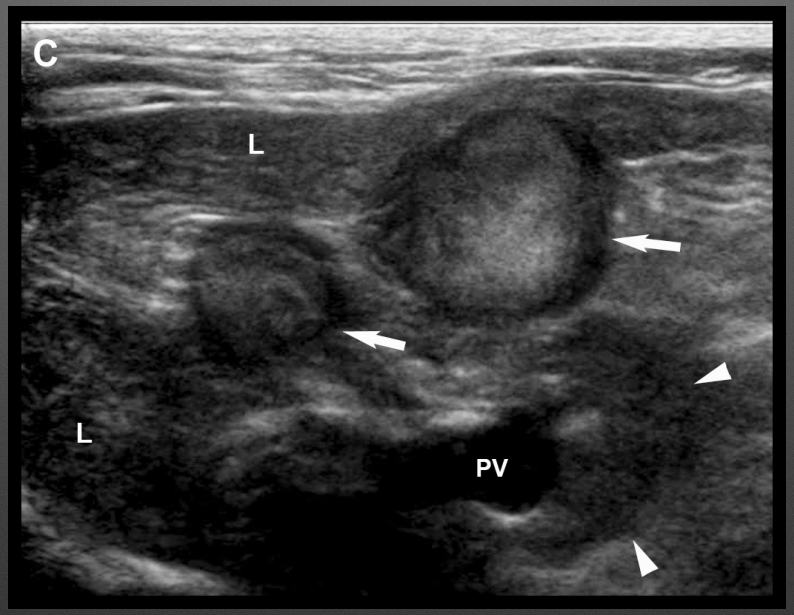
From the Atlas of Small Animal Ultrasonography

Metastases

Metastases from Thyroid Carcinoma

Metastases from Hemangiosarcoma

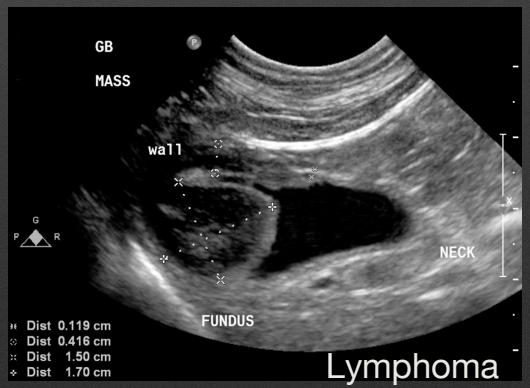
Not all nodules are tumoral…



Eosinophilic sclerosing hyperplasia in an 8-year-old cat

GB Nodule or Mass

Mucosal hyperplasia



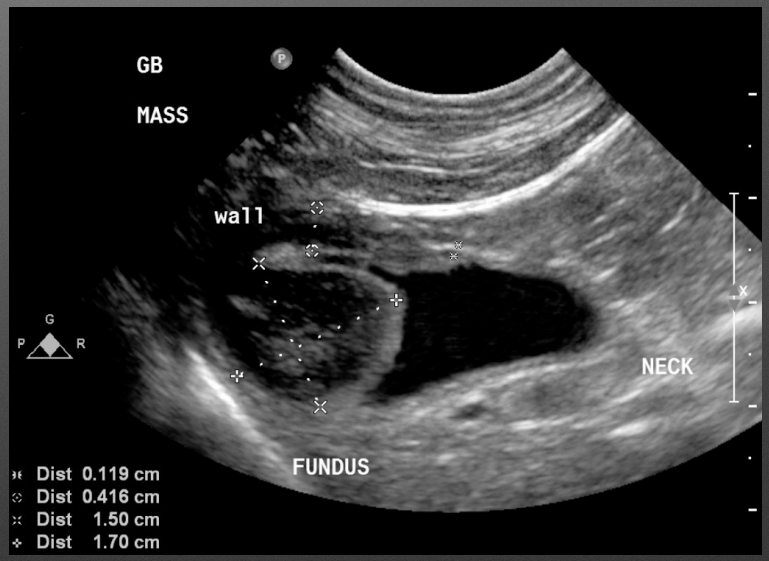
Lymphoma

Polyp, polyp-like focal lesions= common

In people: Adenomyomatosis of the GB is a hyperplastic cholecystosis of the gallbladder wall

GB Wall nodules

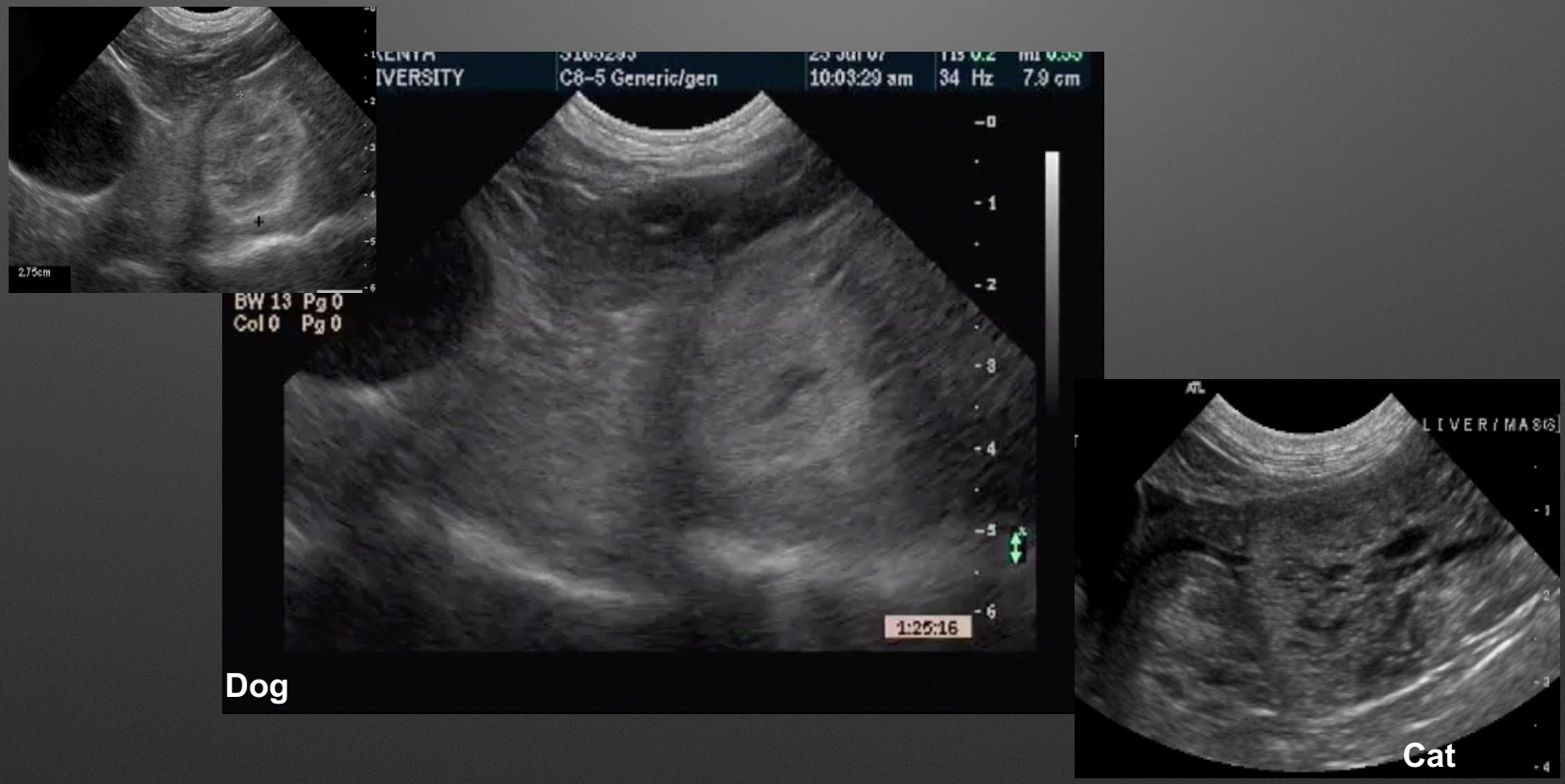
Mucosal hyperplasia



Lymphoma

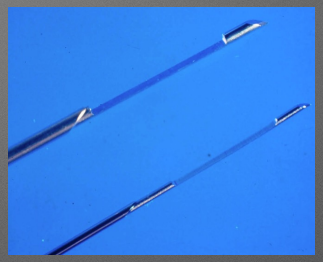
Biliary Cystadenoma

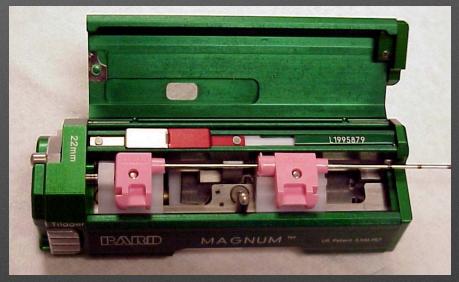
Characterized by focal or multifocal cystic proliferation of biliary epithelium



Interventional Procedures

- 20-22 gauge spinal needle
- Aspiration or capillarization technique
- Extension set for aspiration
- 6 to 10 ml syringes





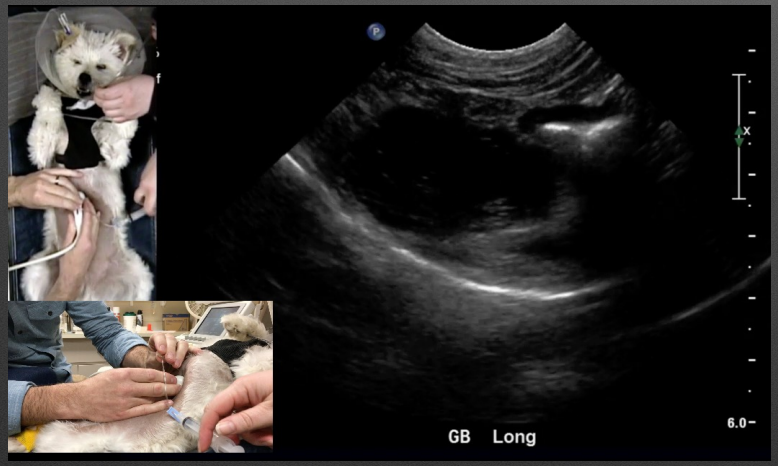
- Tru-Cut needles (14 to 18 gauge)
- Biopsy gun

Interventional Procedures

- Liver sampling (FNA and/or core biopsy)

Interventional Procedures

- Cholecystocentesis (sampling for culture, cytology)
- Decompression drainage



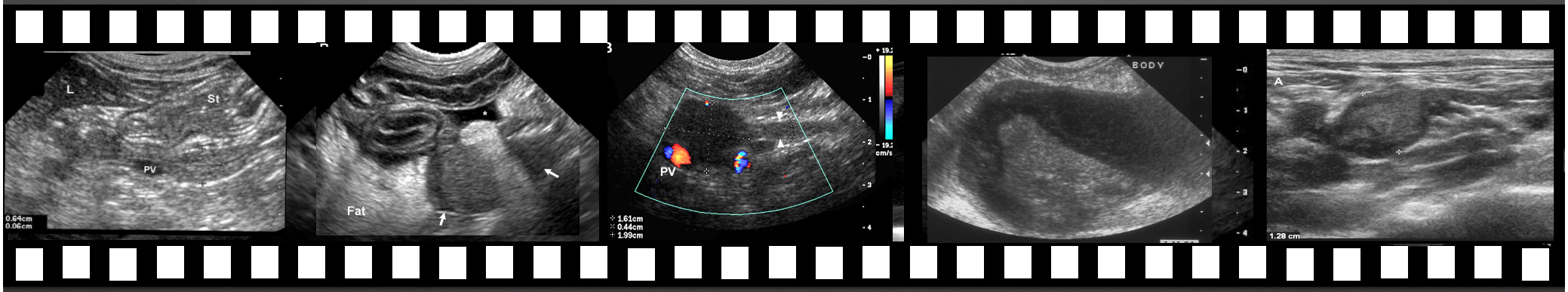
Take home message…

- Carefully evaluate the *entire* liver parenchyma and biliary tree
- Size, location, shape, thickness, integrity and contents MATTER!
- Always place your findings in the clinical context
- When pertinent, safely sample…

The end

Ultrasound Exploration of the Pancreas

In Dogs and Cats

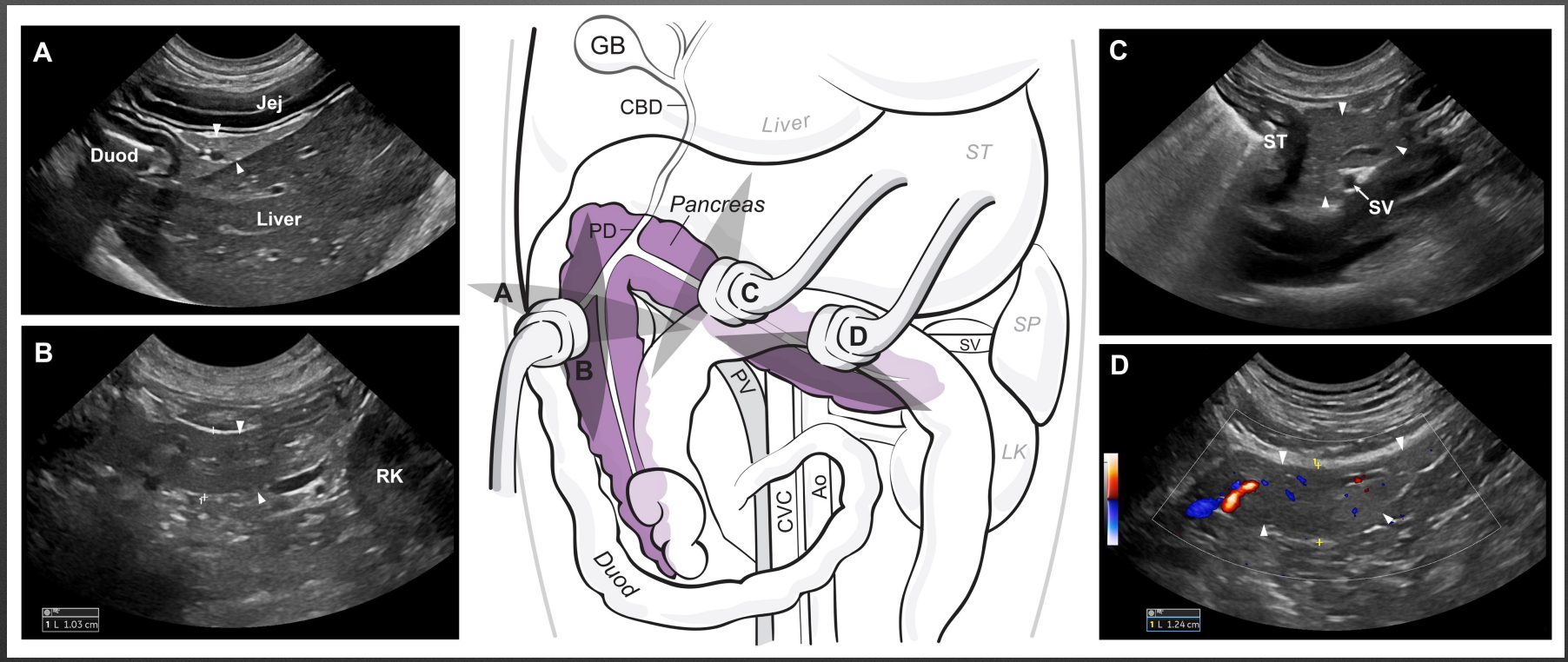


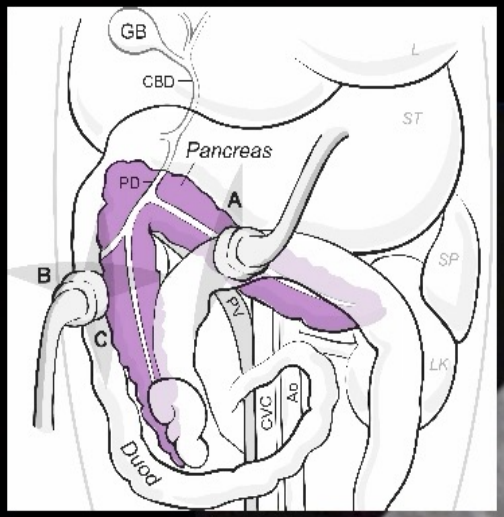
Dominique Penninck, DVM, PhD, DACVR, DECVDI
Professor, Diagnostic Imaging, Tufts University

Objectives

- US features of the normal pancreas in dogs and cats
- Identify the common features for:
  - pancreatitis (acute versus chronic),
  - complications of pancreatitis,
  - pancreatic neoplasia (insulinoma, carcinoma, lymphoma)
  - EPI
- Interventional procedures

Scanning the Dog





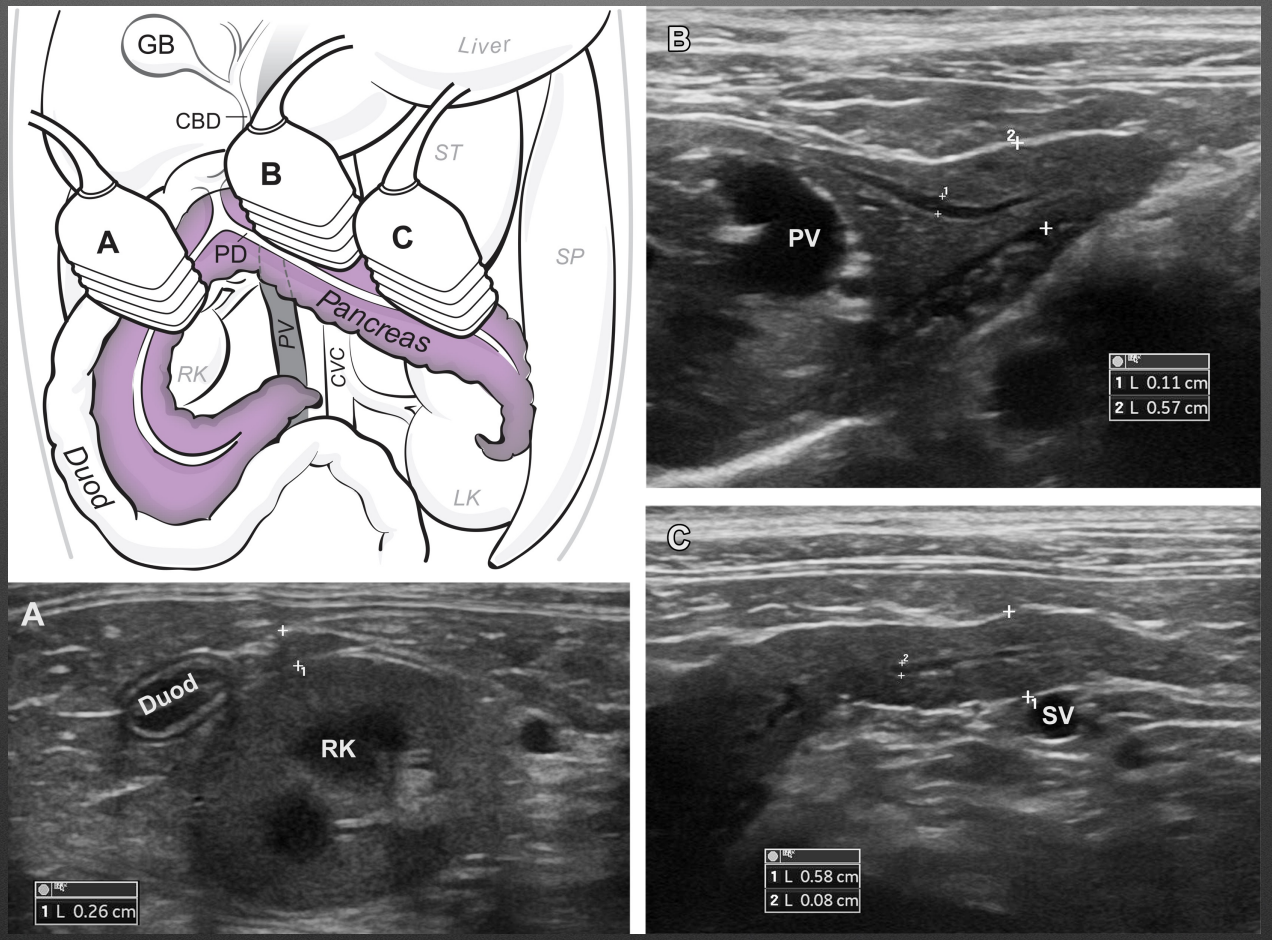
Pancreas
(right)

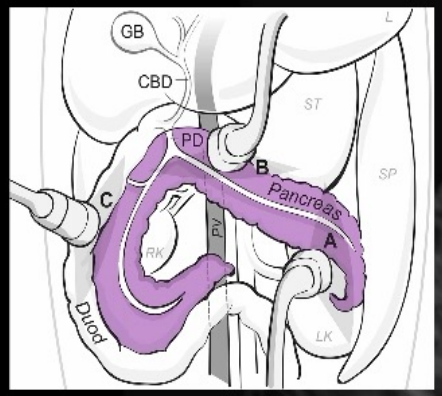
Duodenum

Liver

0:25:29

Scanning the Cat





Left Pancreas

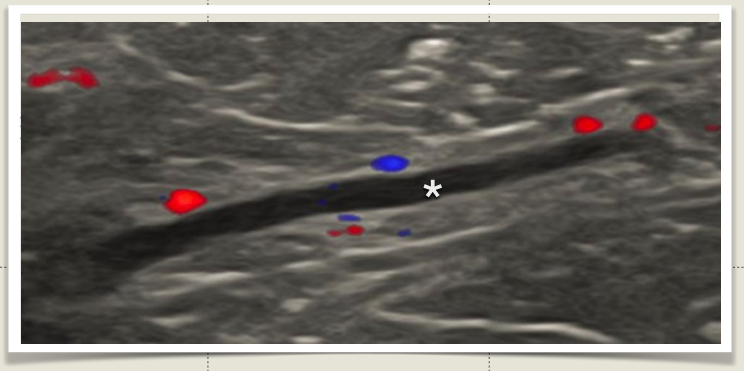
Pancreatic measurements

Mean measurements

	Left lobe	Body	Right lobe	PD
DOG	6.5 mm	6.3 mm	8.1 mm	0.6 mm
CAT	5.8 mm	6.2 mm	4.4 mm	1 mm

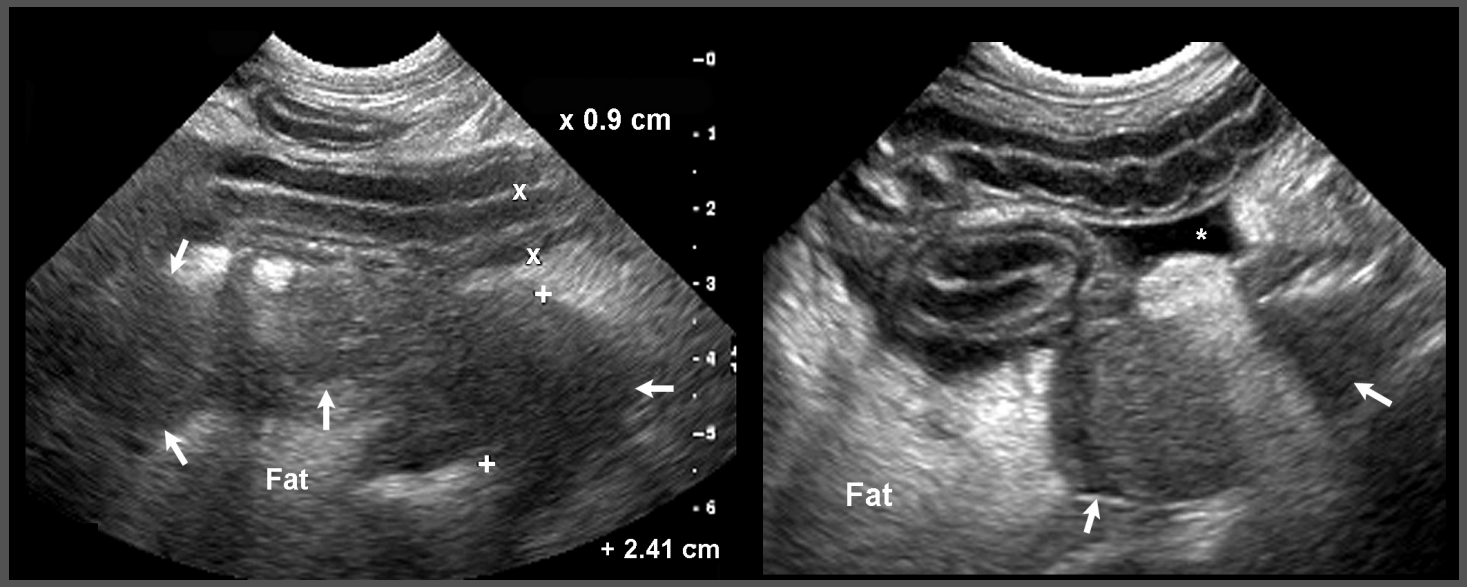
Pancreatic measurements

Mean measurements

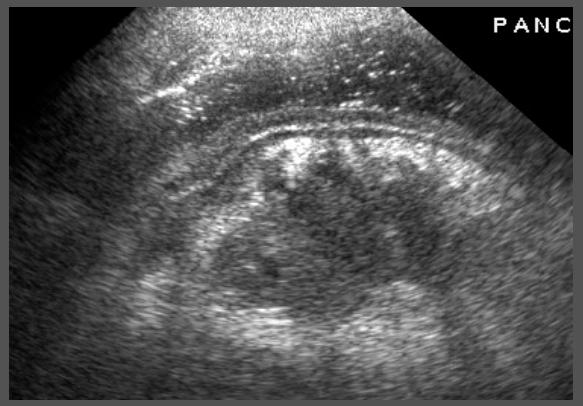
	Left lobe	Body	Right lobe	PD
DOG				0.6 mm
CAT	5.8 mm	6.2 mm	4.4 mm	1 mm

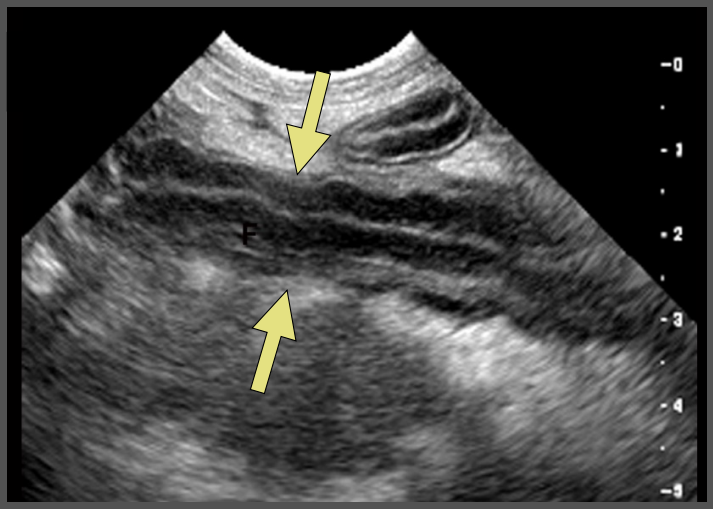
Pancreatitis in Dogs

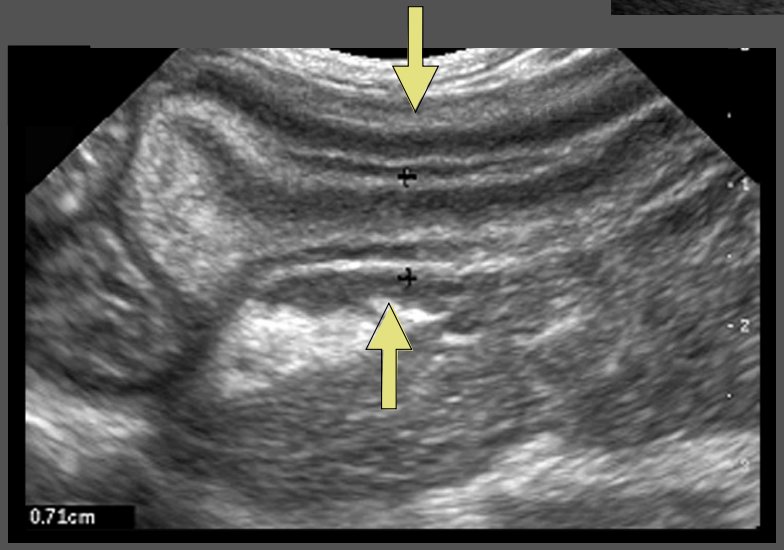
- Hypoechoic, enlarged pancreas
- Hyperechoic fat
- Thickened duodenum
- Fluid/gas distension in duodenum



GI Changes





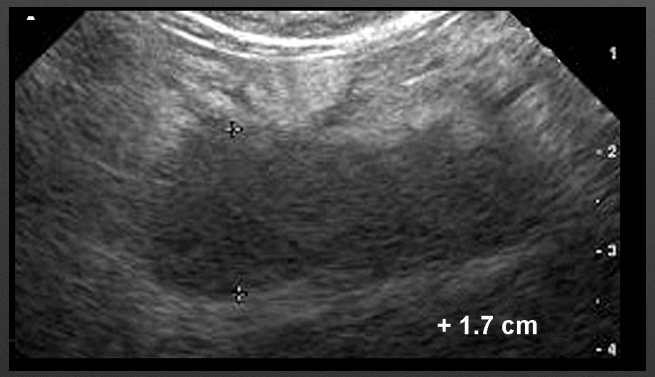


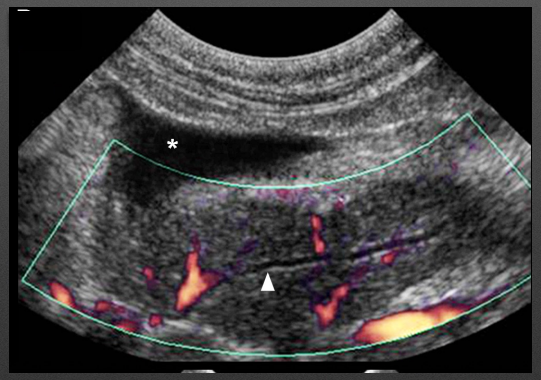
Acute Pancreatitis

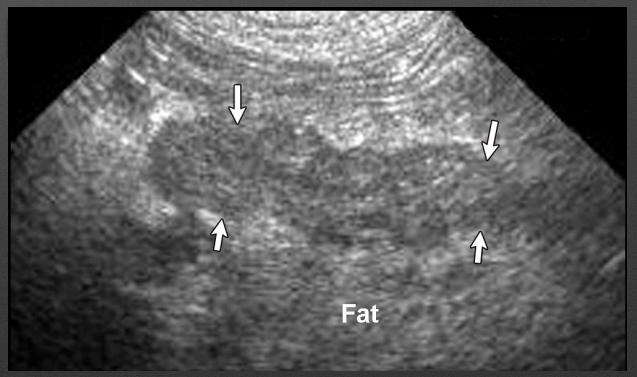
In a 11-year-old Griffon Bruxellois presented for acute vomiting (several hours). He ate a bag of cat food. The dog has a history of well managed Cushing's disease.

Pancreatitis in Cats

- Chronic/subacute pancreatitis is more common in cats; the US features are more subtle
- hypoechoic, enlarged pancreas, surrounded by bright fat in acute pancreatitis
- Unlike in dogs, the left lobe is the most commonly affected

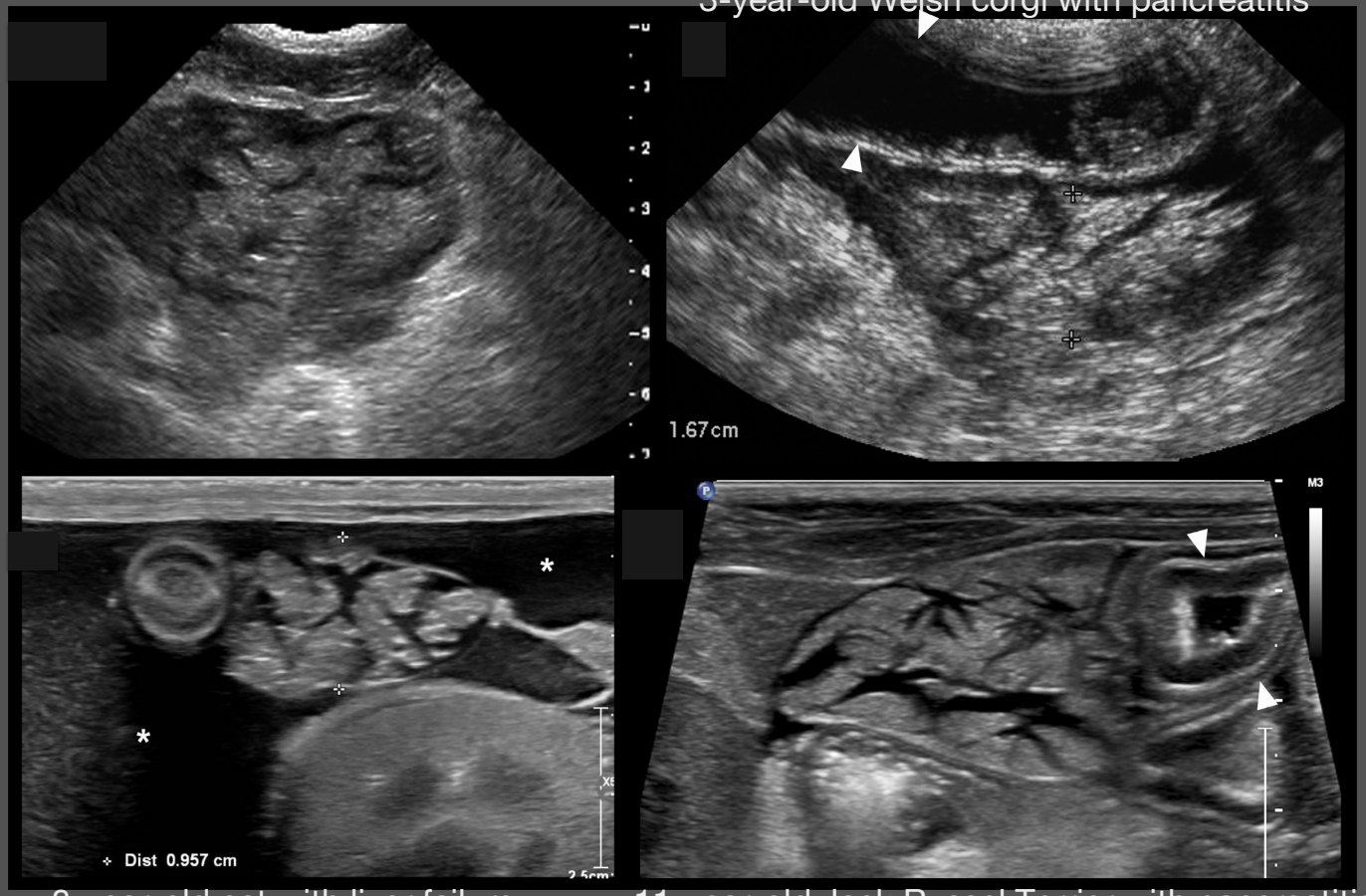






Pancreatic Edema

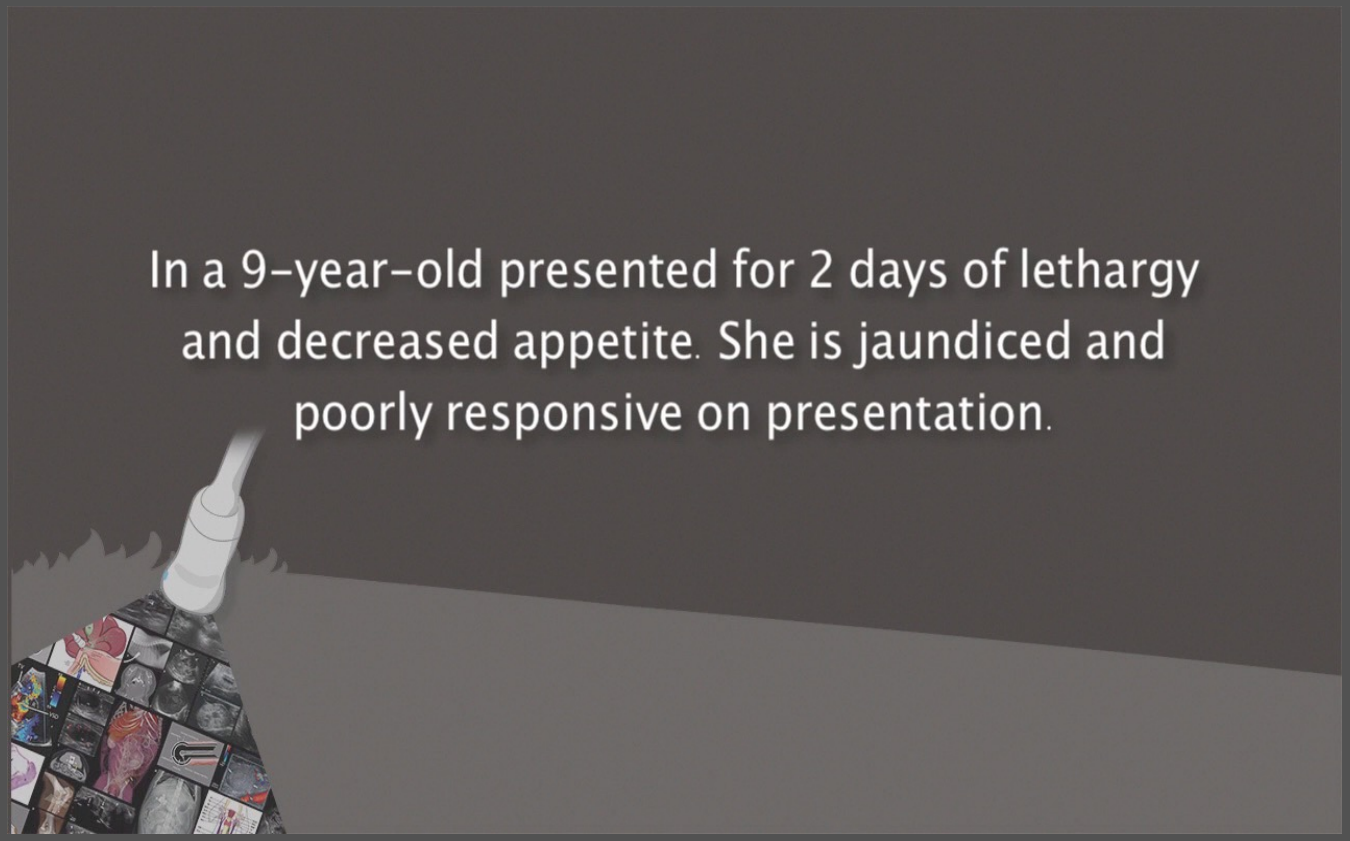
3-year-old Welsh corgi with pancreatitis



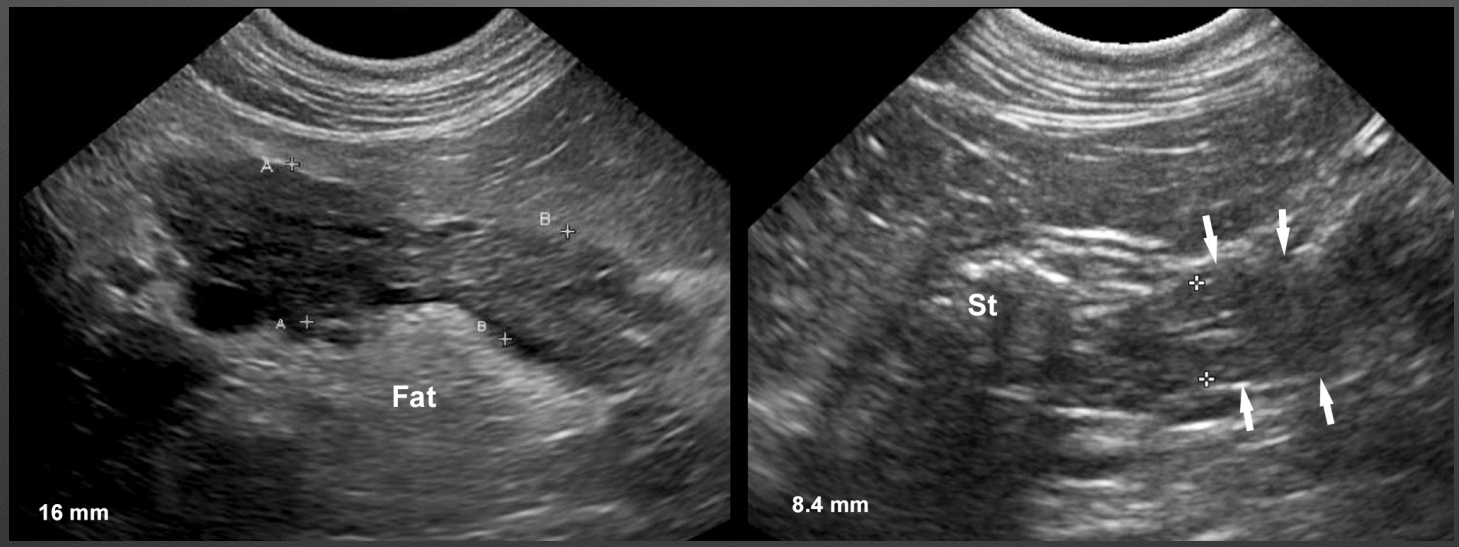
8-year-old cat with liver failure

11-year-old Jack Russel Terrier with pancreatitis

Pancreatitis in Cats



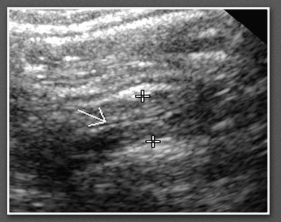
Monitoring of pancreatitis in a cat



6-year-old cat with severe pancreatitis

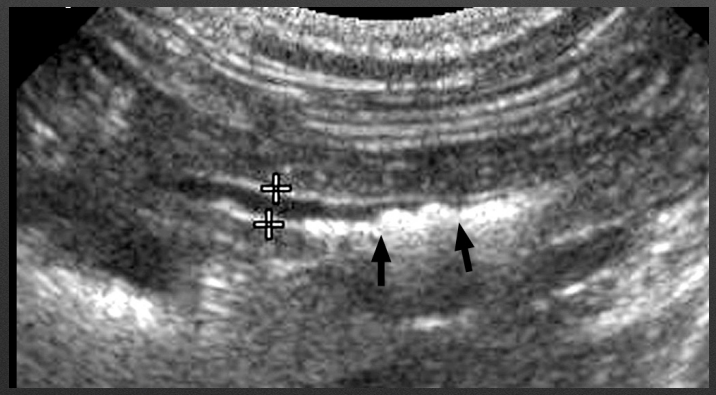
8 days recheck

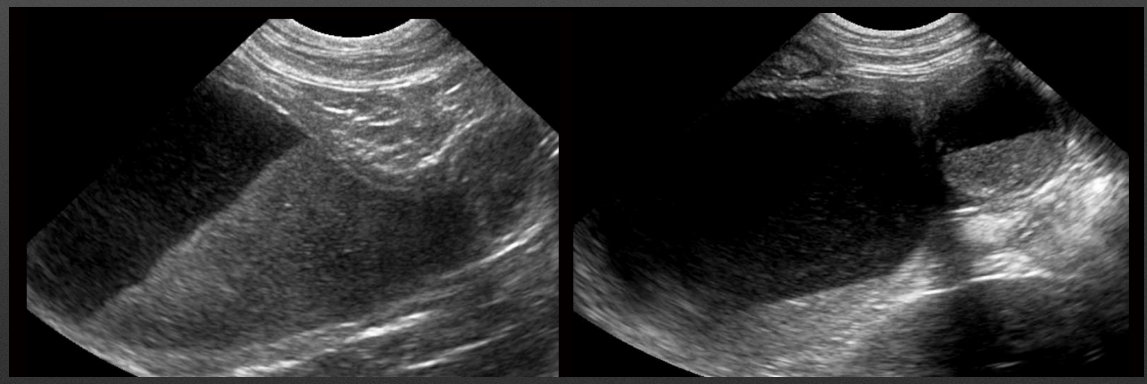
Pancreatic duct in Cats



12-year-old cat

16-year-old cat with concurrent hepatitis



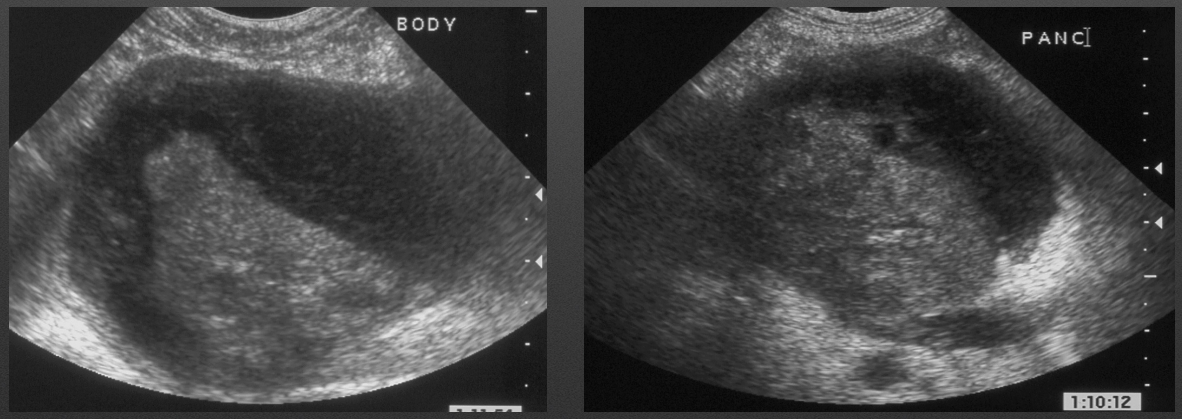


15-year-old cat with progressive inappetence

Pancreatic duct in elderly cat

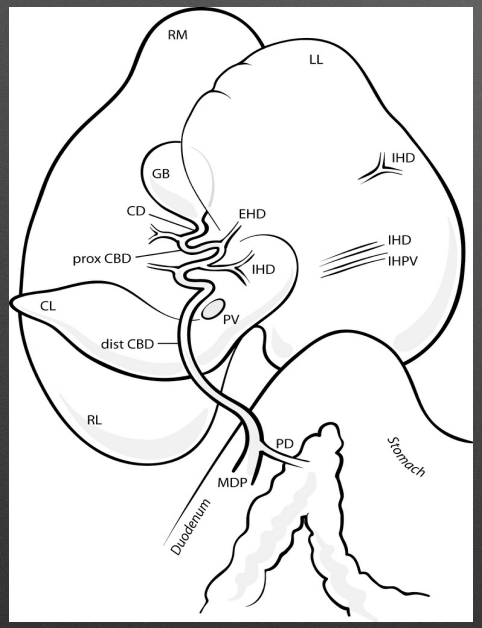
Complications of Pancreatitis

- Extrahepatic biliary obstruction (compression of CBD)
- Necrotizing pancreatitis
- Pseudocyst (sterile pancreatic juice enclosed by a wall of fibrous or granulation tissue)
- Retention cyst (focal dilation of the PD)
- Abscess (pus collection with no or little pancreatic necrosis)



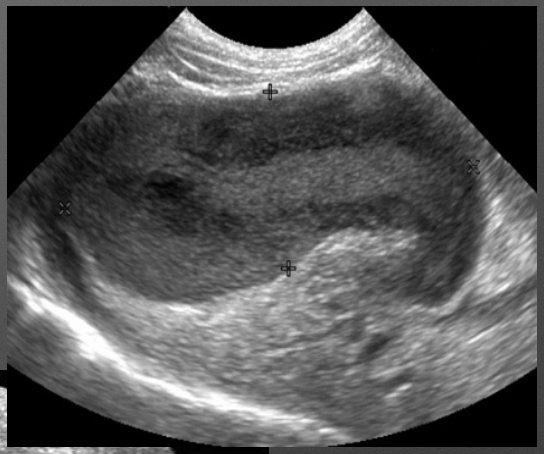
Pseudocyst

Extrahepatic Biliary Obstruction



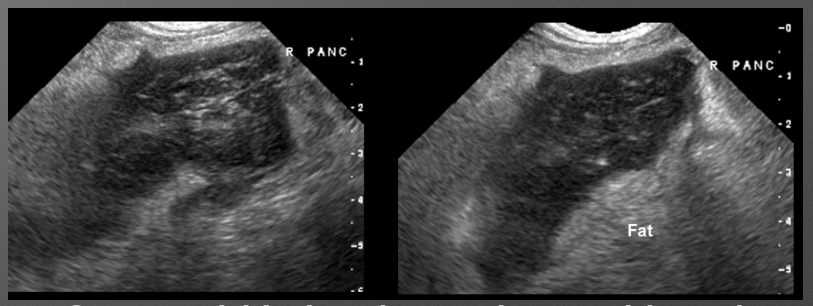
- **Pancreatitis/pancreatic abscess**
- **pancreatic tumor**

- calculi in CBD
- lymph node enlargement
- GI tumor
- hepatic mass

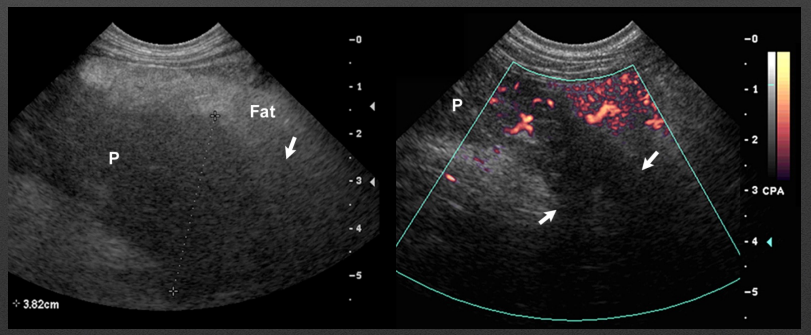


Necrotizing Pancreatitis

In a 12-year-old miniature Schnauzer presented for vomiting and painful abdomen. The dog has markedly elevated liver enzymes and total bilirubin for the past 3 days.

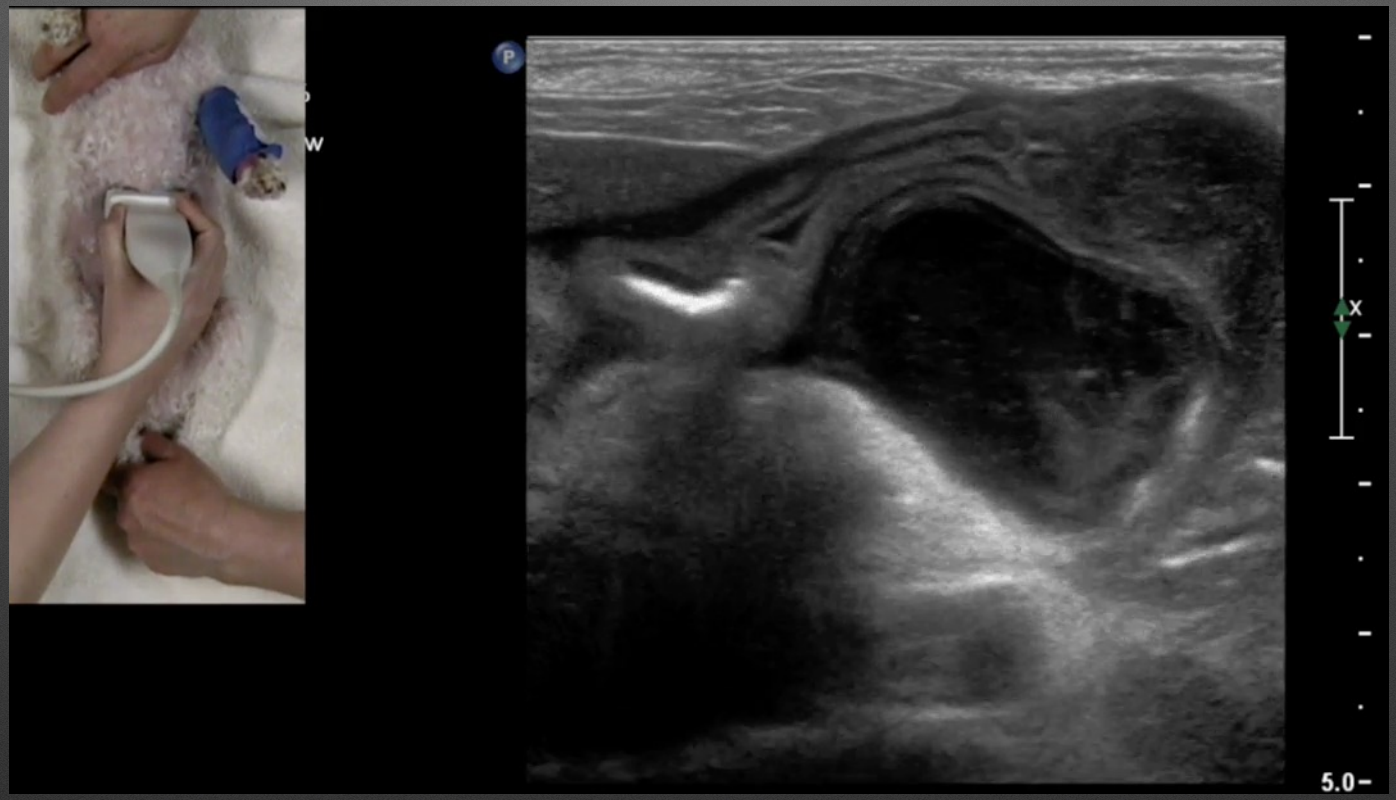


8-year-old Labrador retriever with active suppurative pancreatitis



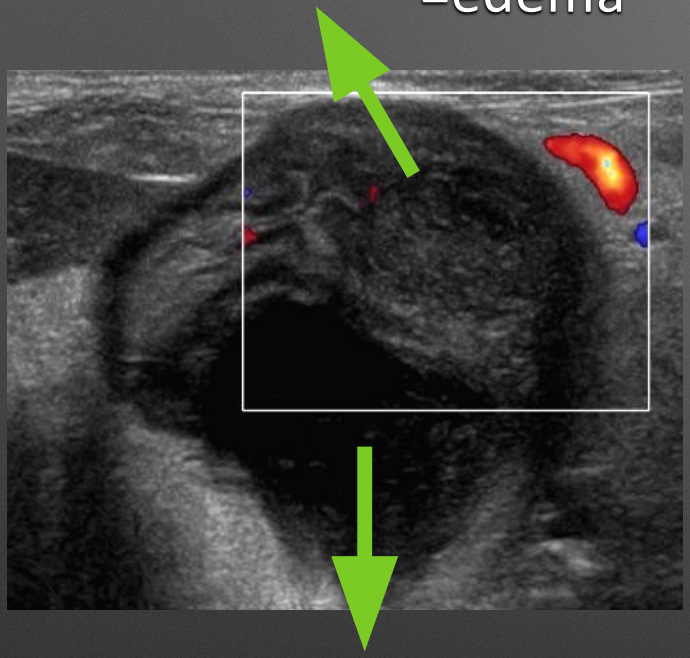
10-year-old Golden retriever

Pancreatic Pseudocysts



8-year-old Poodle has been vomiting for 10 days.
Not responding to initial medical management

“spongy” thickening of gastric wall
=edema



Fluid-filled pancreatic cavity

Outcome

Based on the US findings, a pancreatic pseudocyst or abscess was suspected. A FNA was performed to rule out an abscess.

A recheck US was performed 3 days later to monitor response to treatment. The gastric and pancreatic changes were significantly reduced in size.

Further monitoring may be useful.

US features of presumed gastric wall edema in 14 dogs with pancreatitis

Background: Gastric wall edema has not been reported as a complication of acute pancreatitis in dogs.

Objective: To describe the ultrasonographic features of gastric wall thickening in dogs with acute pancreatitis.

Animals: Fourteen dogs with ultrasonographic evidence and clinical diagnosis of acute pancreatitis, with ultrasonographic evidence of increased gastric wall thickness (>5 mm).

Methods: A retrospective search in the medical records from 2014 to 2016 was performed to identify dogs that had ultrasonographic evidence of acute pancreatitis, that had increased thickness of the gastric wall and that were diagnosed with acute pancreatitis clinically. The gastric wall changes such as thickness, layering appearance, echogenicity, distribution of lesions, and perigastric changes were recorded. Serial ultrasonographic examination and histopathological findings were recorded if available.

Results: Mean gastric wall thickness was 9.9 ± 4.0 mm (SD). A complete loss of wall layering was observed in 2 dogs. Thickening of the submucosal layer was observed in 12 dogs, and 5 of them had concurrent muscularis layer thickening. The echogenicity of thickened submucosal layer was intermediate hyperechoic. Lacy appearances were present within the thickened submucosal layer in 7 dogs and in the muscularis layer of 1 dog. Thickening was focal in 12 dogs and adjacent to the diseased pancreas. Subsequent resolution of gastric wall thickening was observed in 3 dogs (range 3-28 days) via follow-up ultrasound. One dog underwent necropsy, and gastric wall edema was confirmed histopathologically.

Conclusions and Clinical Importance: Findings indicated that gastric wall thickening presumably because of edema could be a complication of acute pancreatitis.

J Vet Intern Med. 2019;33:1260–1265

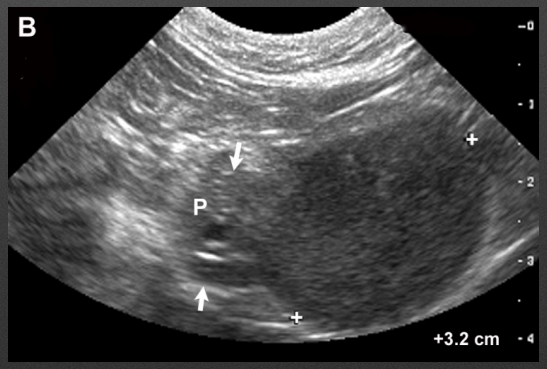
Pancreatic Abscess

- Poorly echogenic fluid
- Irregular cavity(ies)
- Variable wall thickness
- Localized bright fat

- Uncommon, especially in cats

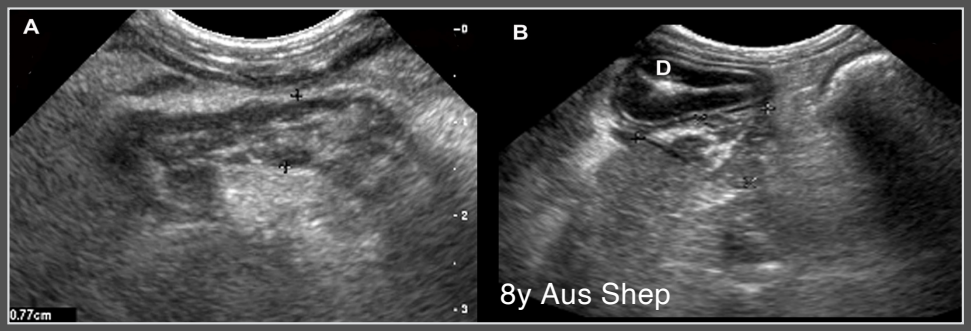
Dog

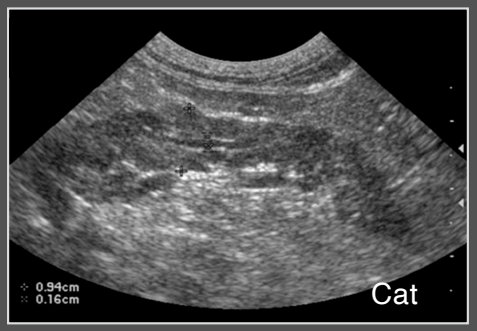
Cat

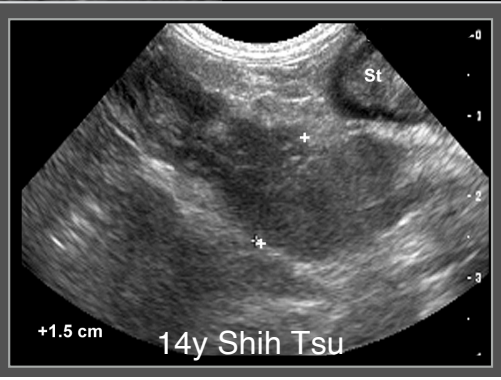


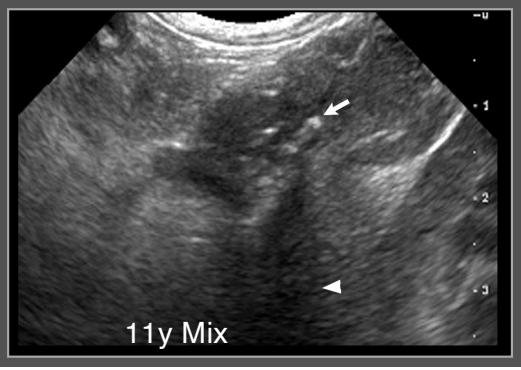
Chronic & Chronic active Pancreatitis

Areas of fibrosis
Areas of mineralization
Irregular contours
Increased echogenicity

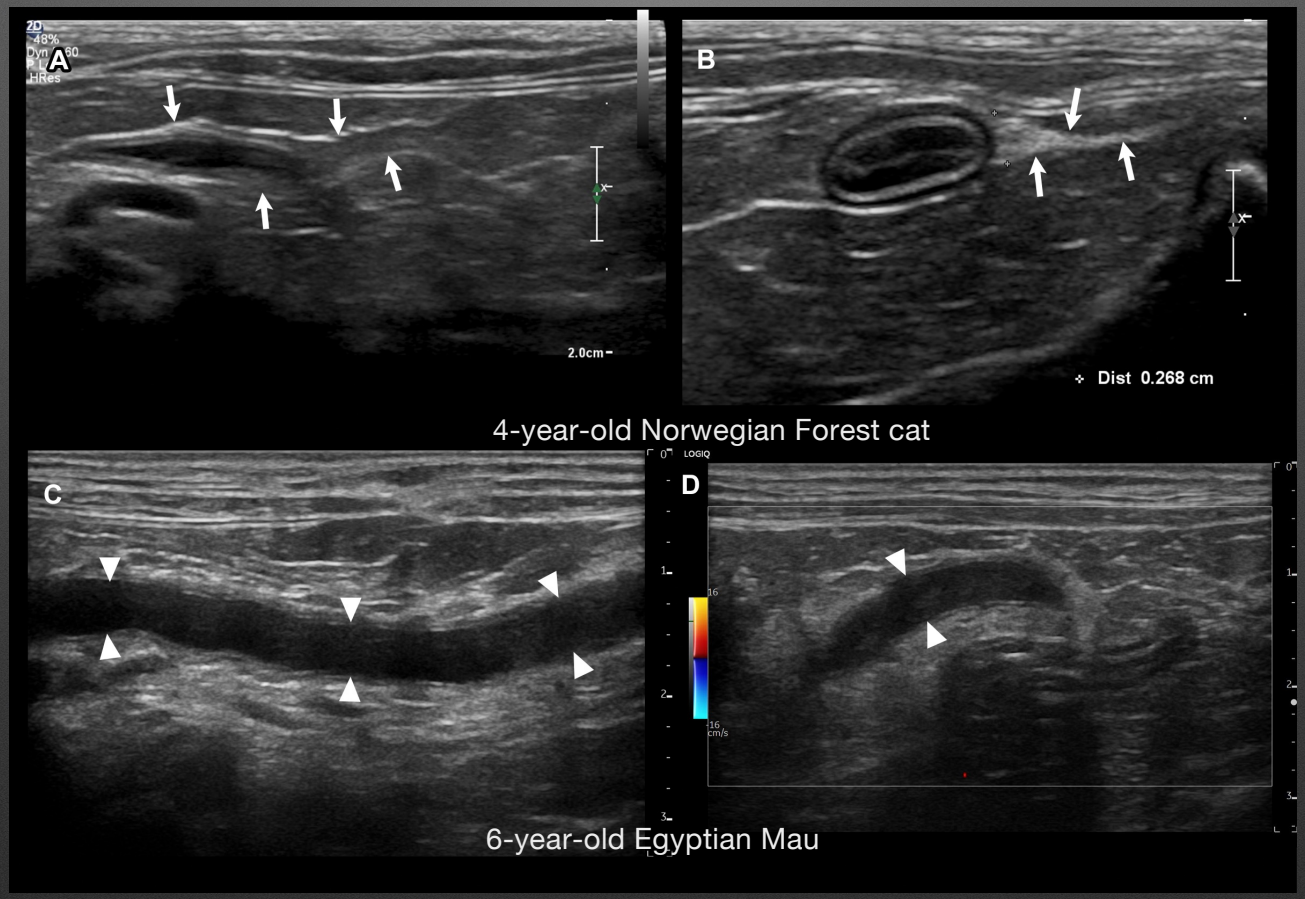








Exocrine Pancreatic Insufficiency (EPI)



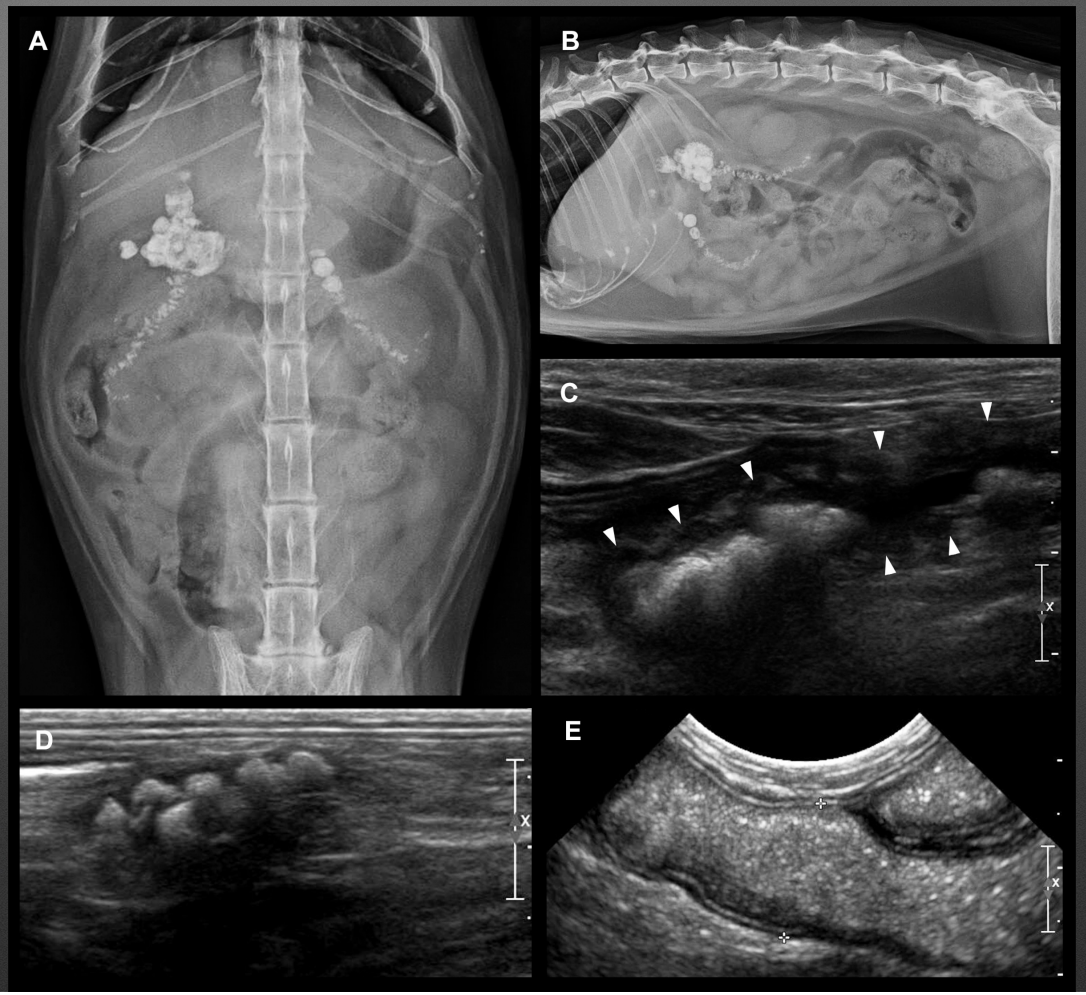
Exocrine Pancreatic Insufficiency (EPI)

*Decreased thickness

*Dilated pancreatic duct

*Hypermotility

*intestinal dilation



Abdominal ultrasound and clinicopathologic findings in 22 cats with exocrine pancreatic insufficiency

Results

The most common clinical sign was weight loss (15/22 cats). Chronic enteropathy was the most common concurrent disease (13/22 cats). In 39% of cats, the pancreas had minimal or no sonographic alterations. Pancreatic duct dilatation (>2.5 mm), pancreatic duct tortuosity with variable diameter, or both were seen in 6/13 cats. The pancreatic parenchyma was subjectively thin in 6 cats. A significant relationship was found between subjectively thin pancreatic parenchyma and increased pancreatic duct size : pancreatic thickness ratio (P = .004). Diffuse gastrointestinal dilatation with echogenic content was observed in 8/22 cats.

Conclusion

Exocrine pancreatic insufficiency often causes minimal to no sonographic pancreatic changes. Nonetheless, the findings of thin pancreatic parenchyma, pancreatic duct dilatation, or diffuse small intestinal dilatation with echogenic contents in cats with unexplained weight loss or unformed feces should raise clinical suspicion for EPI.

Auger M, et al. J Vet Intern Med 2021

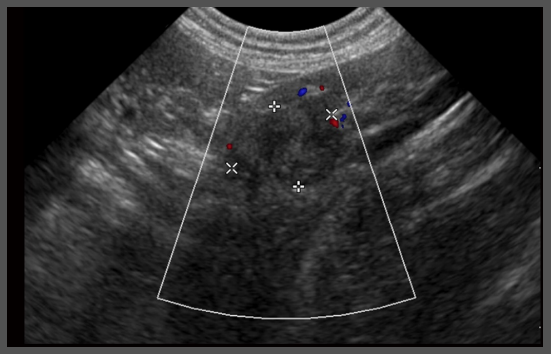
Pancreatic Tumors

Endocrine tumors (from islets of Langerhans)
Insulinoma=most common pancreatic tumor in dogs

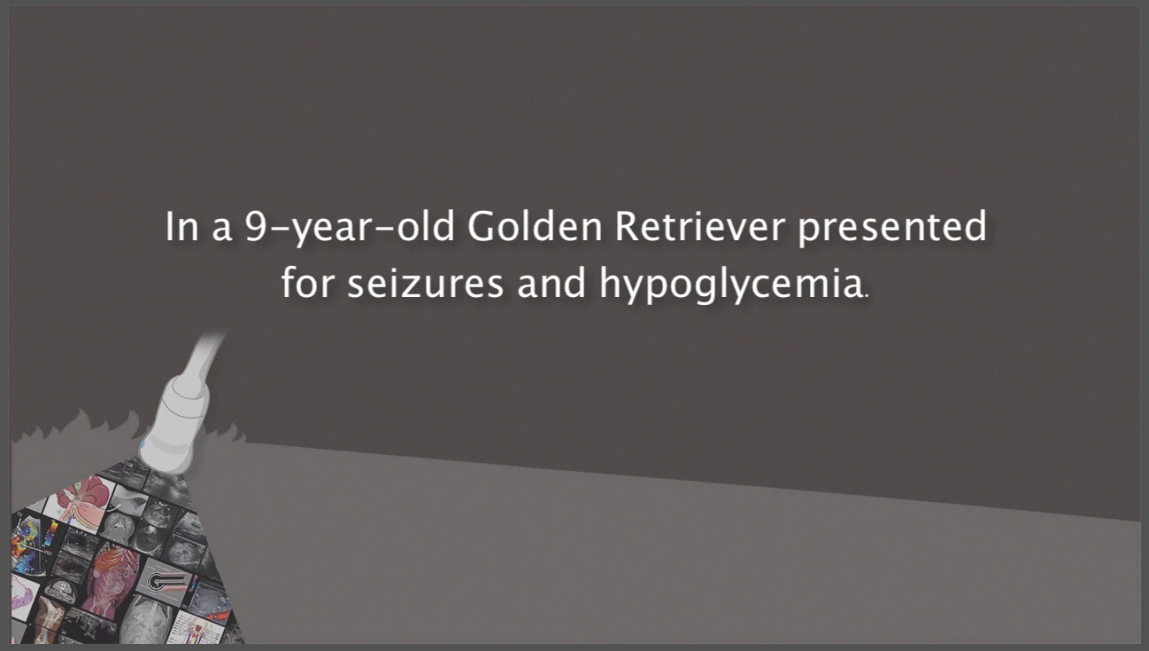
Exocrine tumors (from acinar cells or ductal epithelium)
adenoma, carcinoma, adenocarcinoma

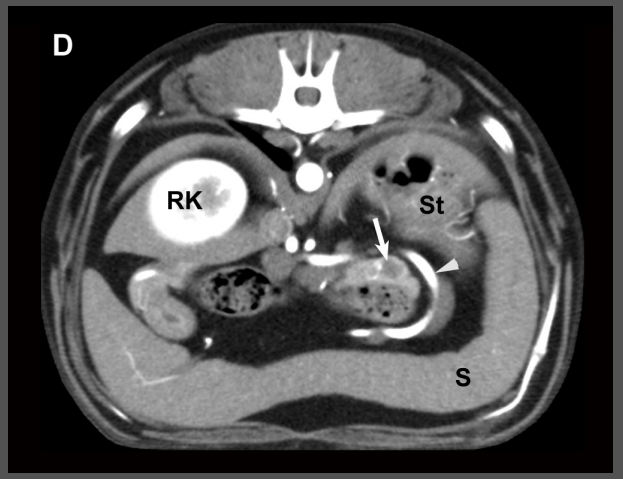
(Lymphoma, metastases, others)

Insulinoma

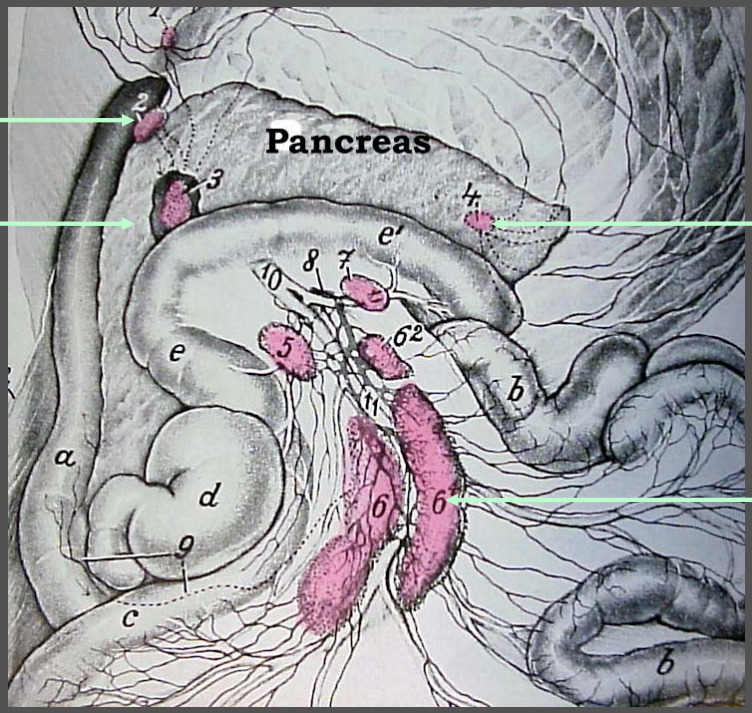


- **Size:** microscopic up to 5 cm
  80% < or = 2.5 cm
- **Other findings:**
  * Regional LN
  * Liver: nodule(s) or mass





Pancreatic nodule or lymphadenomegaly



Lymphatic drainage of pancreas to duodenal, hepatic, splenic, jejunal lymph nodes

Miller's Anatomy of the dog

Pancreatic Carcinoma

In a 15-year-old cat presented for poor appetite, vomiting, dehydration and cranial abdominal pain. The cat was diagnosed with pancreatitis 1.5 year ago.

- ✓ Inappetence, weight loss, lethargy
- ✓ Nodule to large mass
- ✓ Areas of mineralization

Pancreatic Carcinoma

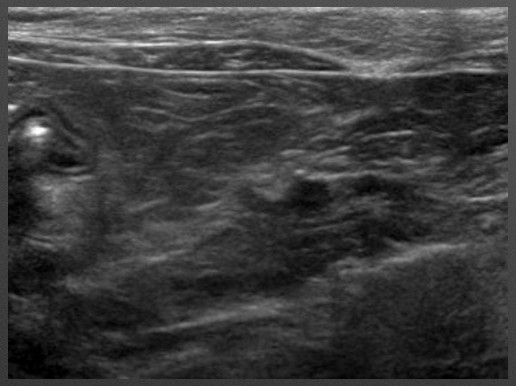
Pancreatic carcinoma with hepatic metastases in a 11-year-old cat

Pancreatic Lymphoma

Non-neoplastic pancreatic nodule/mass

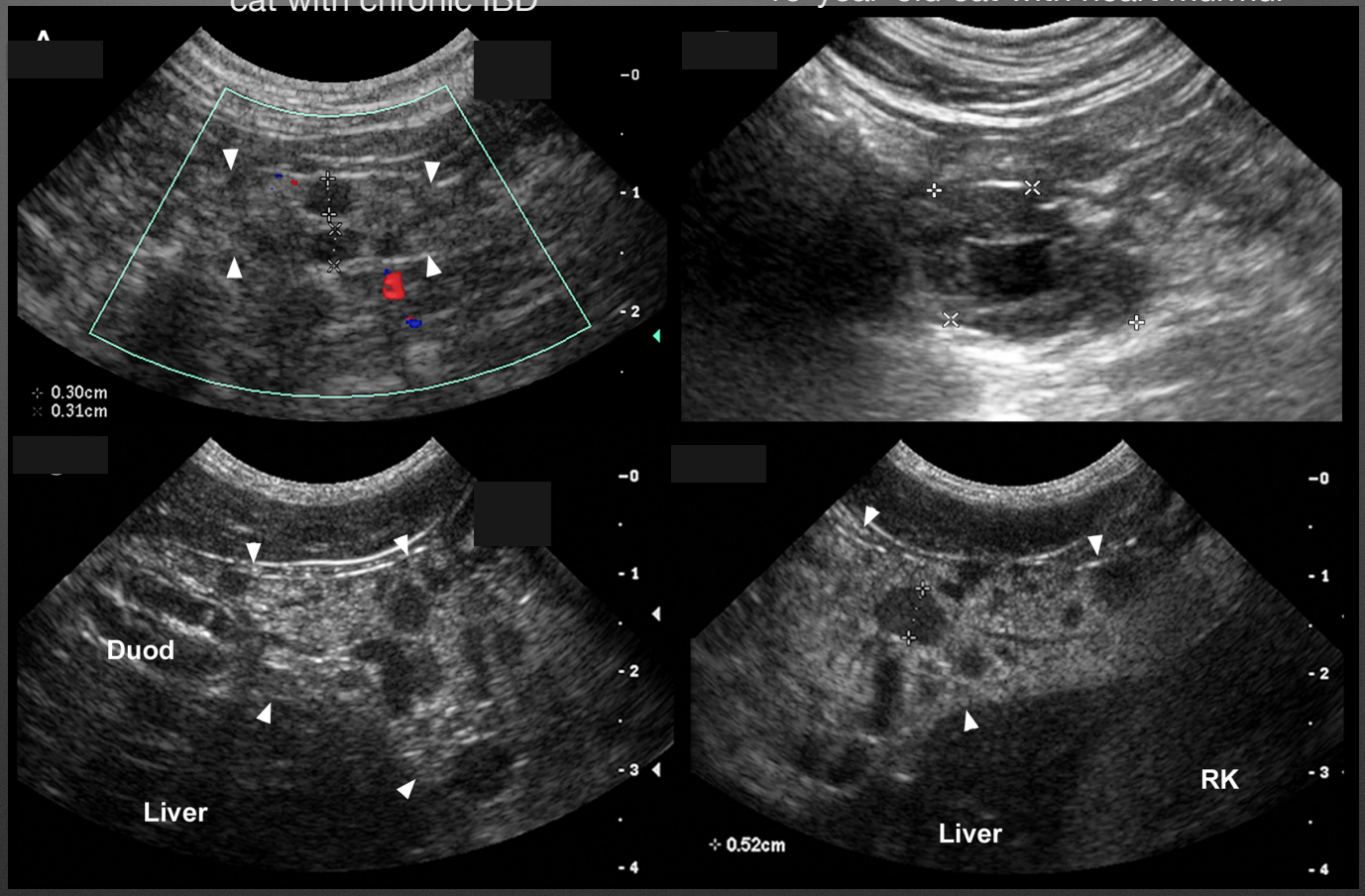
2 cats with adenoma

Nodular hyperplasia



cat with chronic IBD

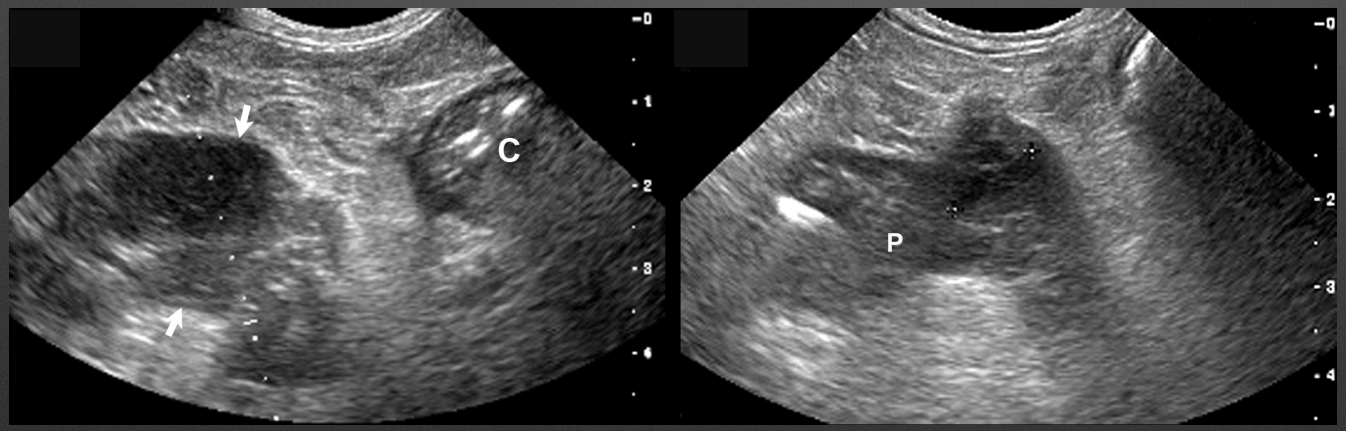
15-year-old cat with heart murmur



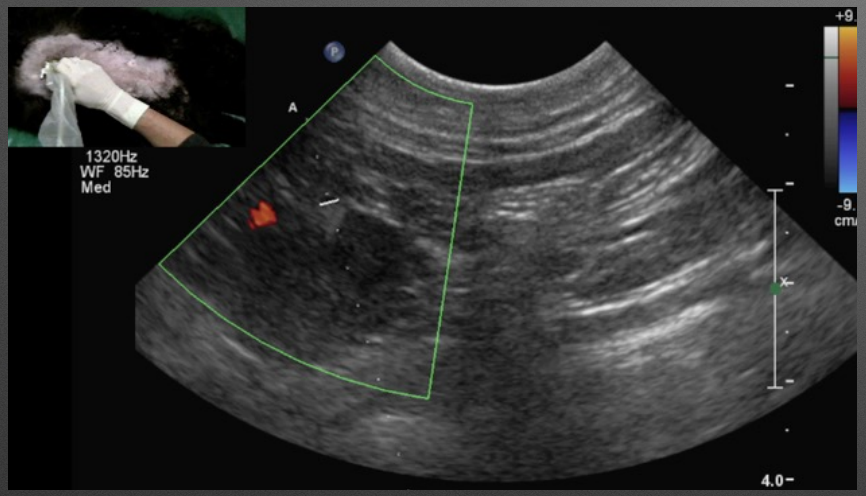
small-breed dog with diabetes mellitus

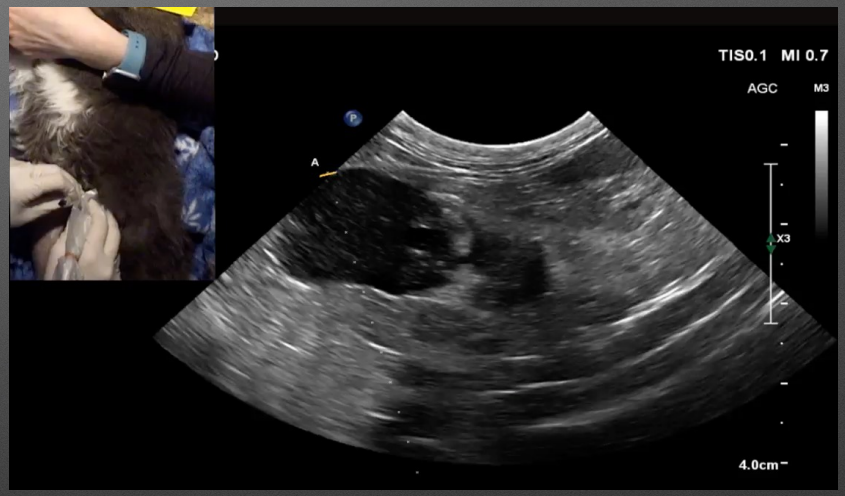
Interventional procedures

- 22-gauge spinal needle/20 gauge tru-cut
- Diagnostic and/or therapeutic method
- Drainage of fluid collections
- Biopsy of nodule or mass



Interventional procedures

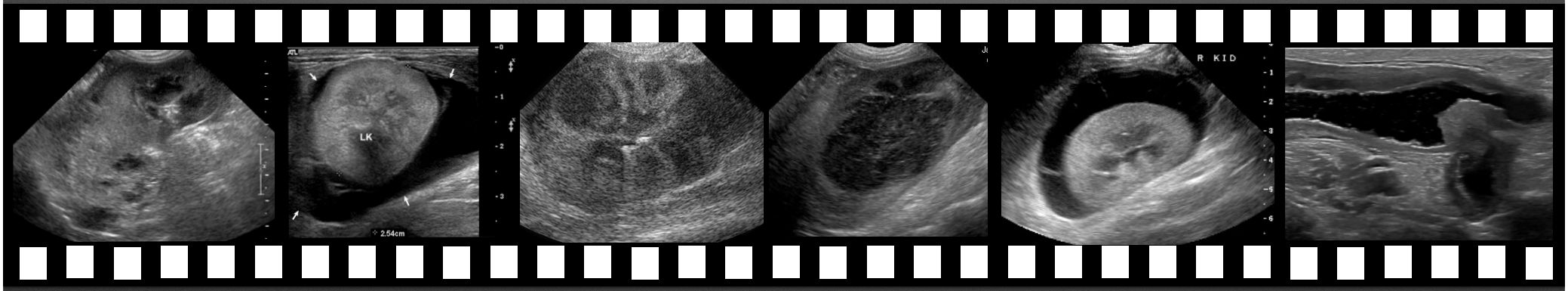




Questions?

Urinary Overview

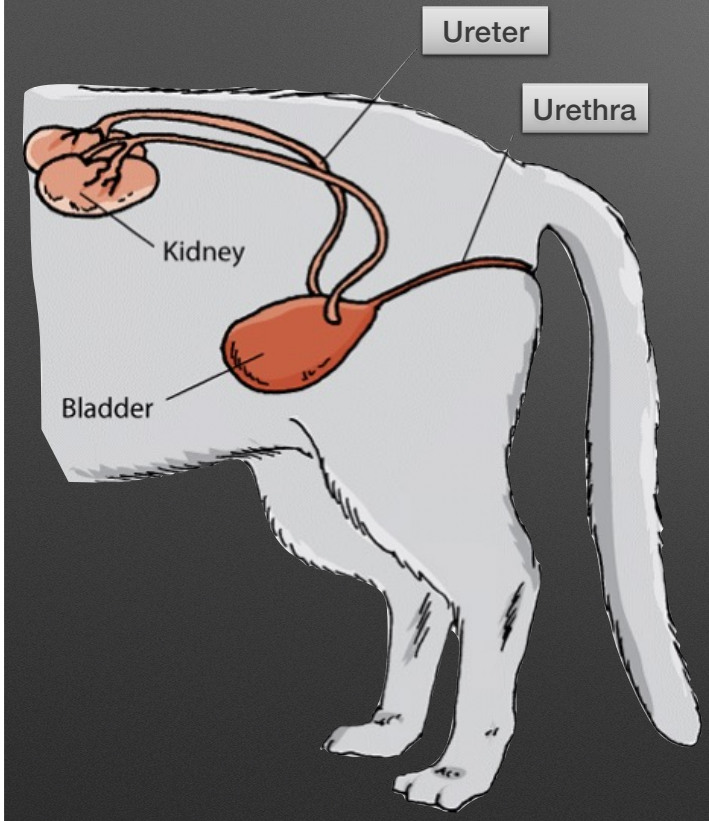
Clinical Approach



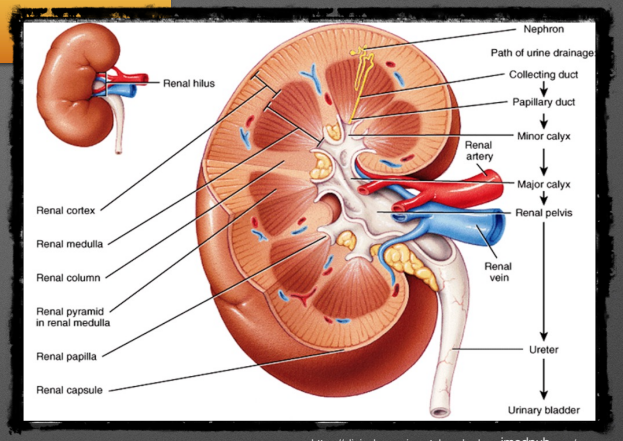
Dominique Penninck, DVM, PhD, DACVR, DECVDI

Professor, Tufts Cummings School of Veterinary Medicine

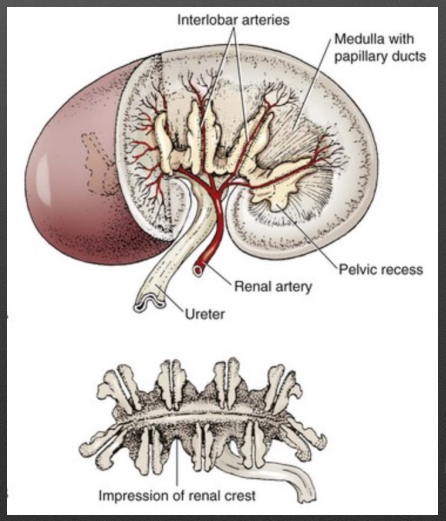
Urinary System



- **Kidney**
- Ureters
- Bladder
- (Urethra)

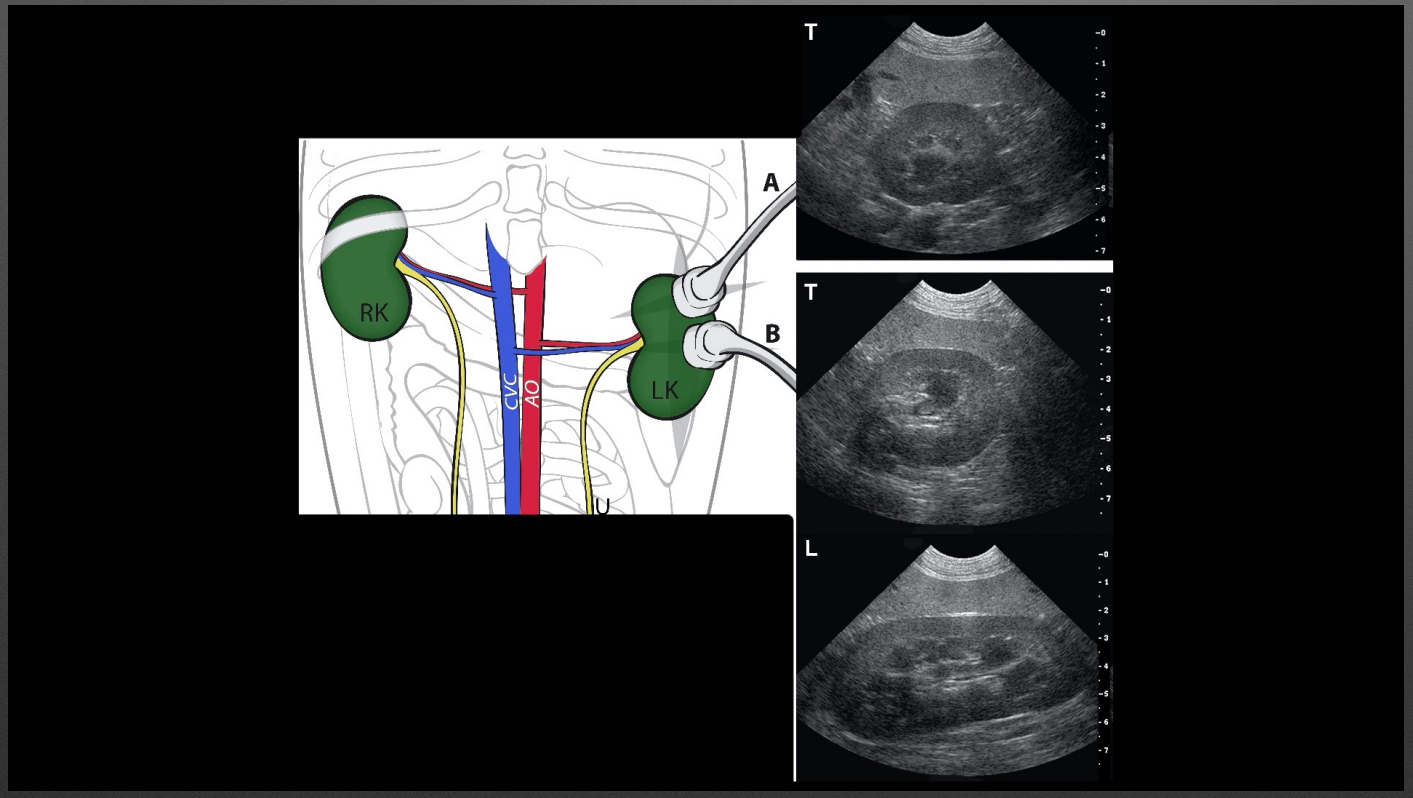


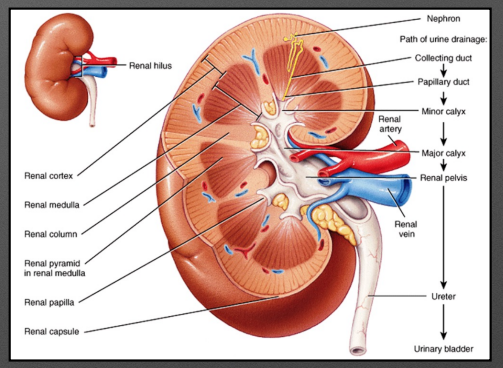
https://clinical-experimental-nephrology.imedpub.com/



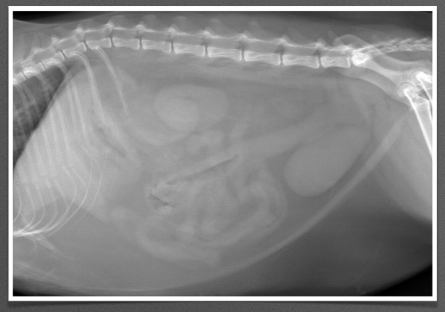
From Dyce KM (ed): Textbook of veterinary anatomy, ed 3, Philadelphia, 2002, Saunders/Elsevier)

US anatomy & scanning



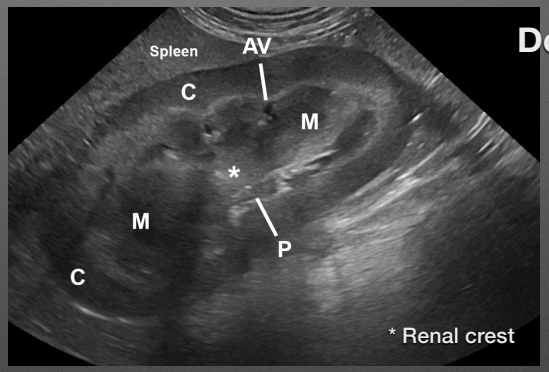


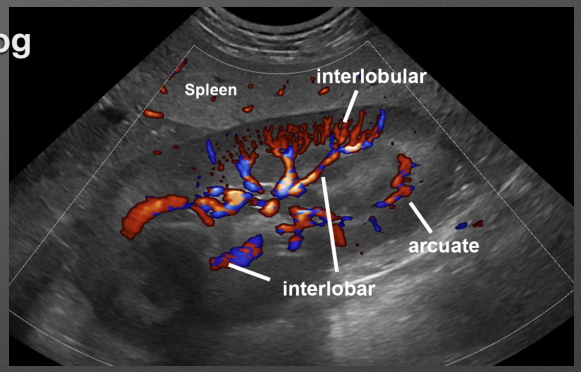
From the Atlas of Small Animal Ultrasonography--Website

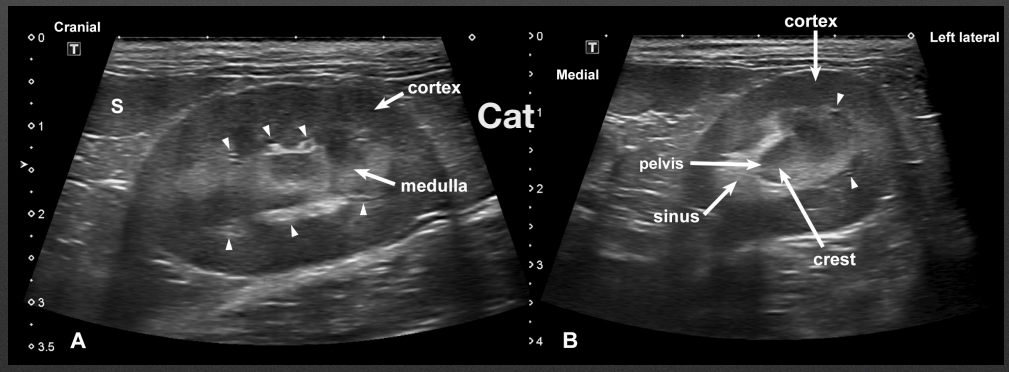


Kidneys: US Features

- Location
- Size
- Shape
- Echogenicity

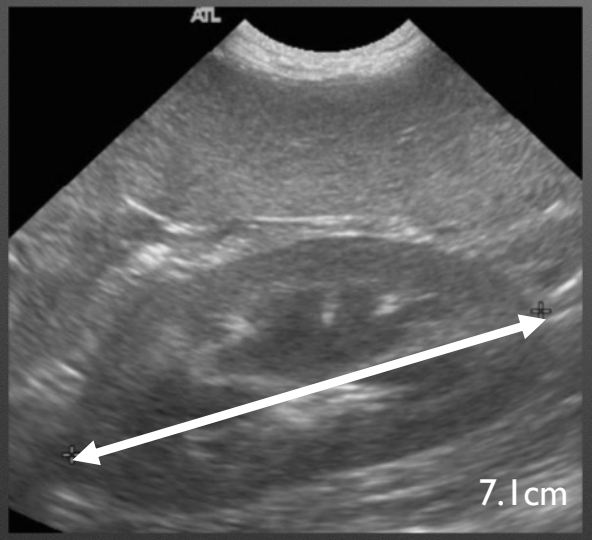






Renal size in dogs

Wide variation in dog size —> wide variation in renal size



0.82 cm

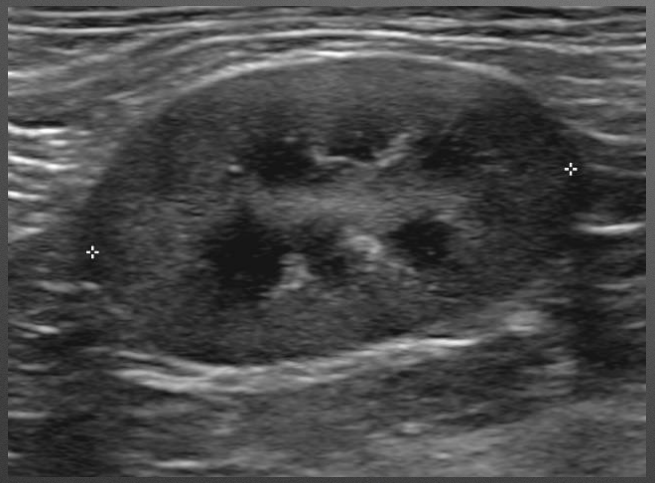
Kidney L/Aorta diameter

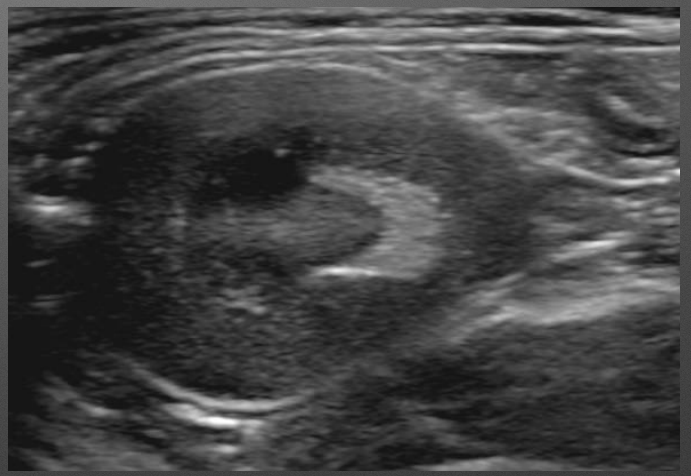
7.1/0.82= 8.7

(normal 5.5 to 9.1)

renal/vertebral length ratios ranged from 1.3 to 2.7

Renal size in cats





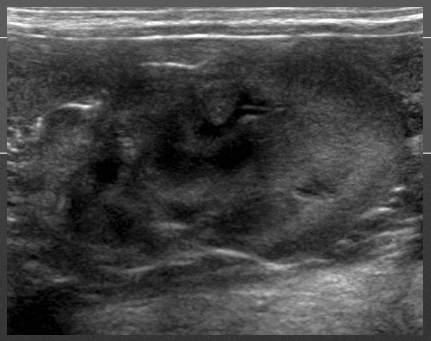
3-4.5 cm in length

Factors: age, neutered, breed
Right kidney longer than left

Overall size changes

INCREASED SIZE	DECREASED SIZE
Perirenal pseudocyst, PKD	Dysplasia
Tumors	CKD
nephritis/pyelonephritis	
Amyloidosis	

HSA Golden Retriever

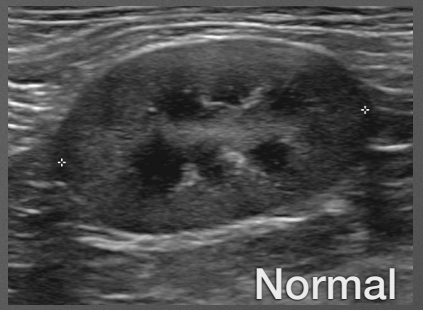


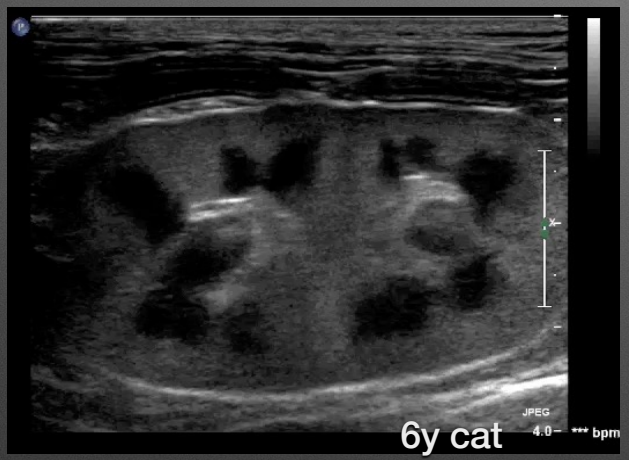
1 Y Beagle renal dysplasia

6m Chow renal dysplasia

Shape & margins

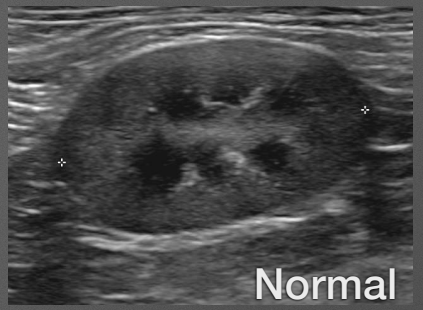
- Bean-shaped=normal
- Horseshoe, fused

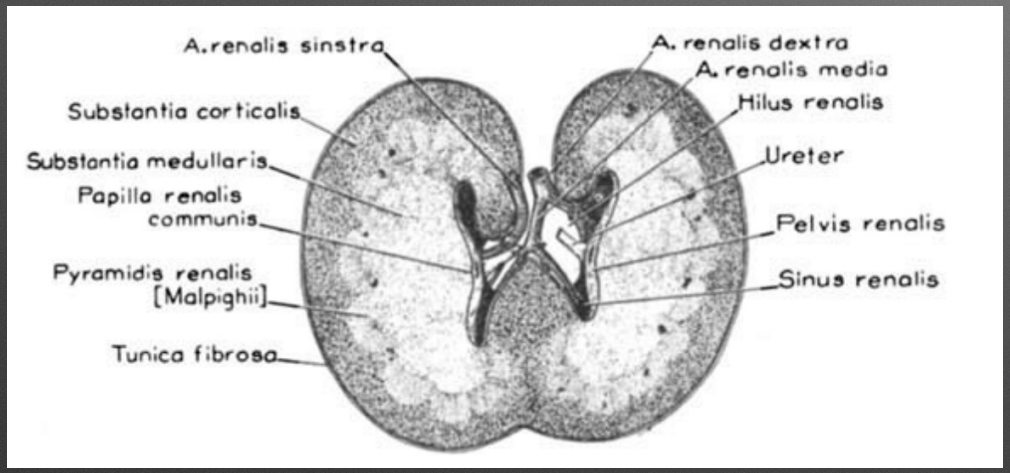




Shape & margins

- Bean-shaped=normal
- Horseshoe, renal fusion





The Anatomical Record (1943) 86;3:307-319

Imaging features of renal ectopia and fusion in 13 cats

Abstract

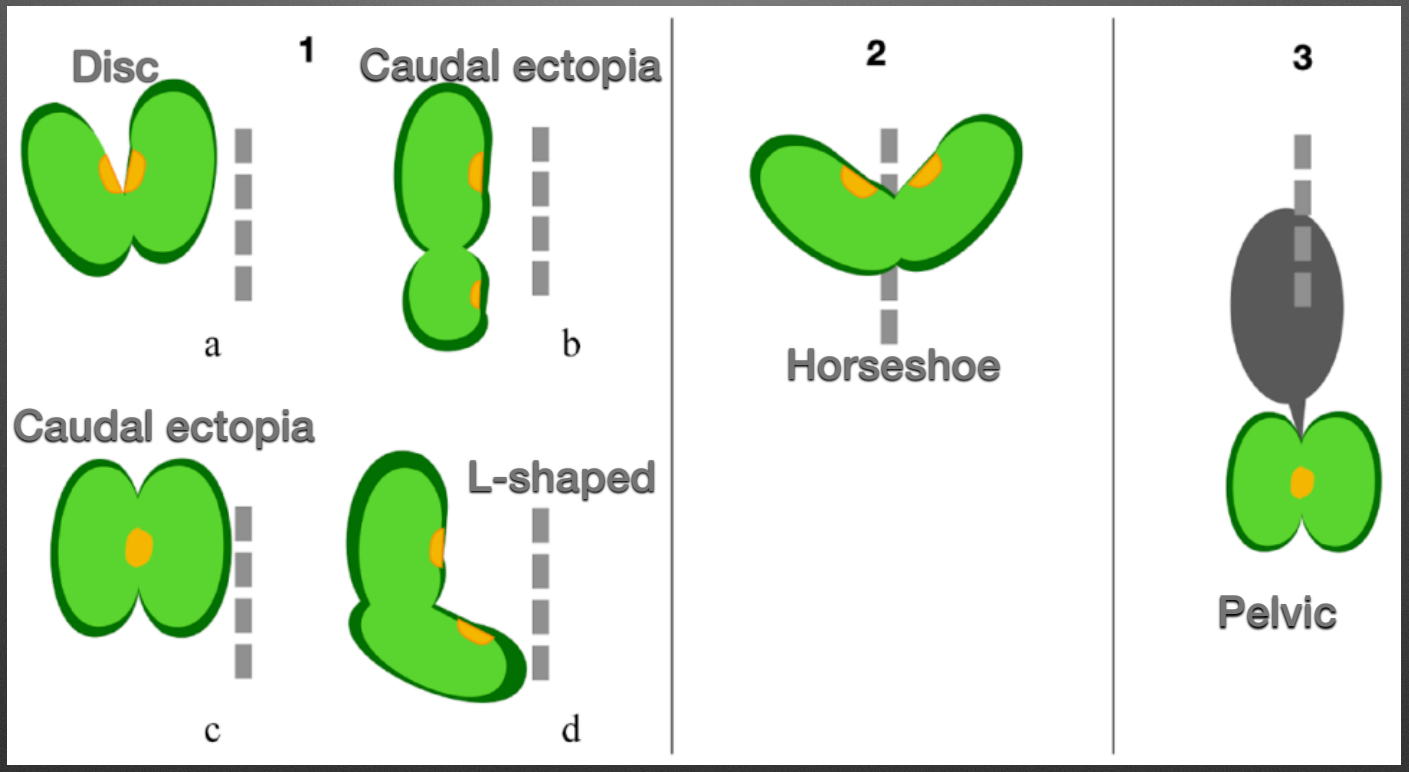
Case series summary A retrospective multicenter case series of renal fusion anomalies in cats was investigated. The aim of this study was to describe the imaging characteristics (radiography, ultrasonography and CT) of renal ectopia and fusion in cats. A total of 13 feline patients (median age 9 years) were included in this multicentric retrospective study. Ultrasound was available in 12/13 cases, radiographs in 4/13 cases and CT in 3/13 cases. Of the 13 cases, seven were left to right fusions, four were right to left fusions, one was on the midline and one was in the pelvic inlet. Adopting a human classification system, there were five lump kidneys, four disc kidneys, one horseshoe kidney, one caudal ectopia, one L-shaped kidney and one pelvic kidney. In 2/13 cases, additional congenital malformations were noted, including an azygous continuation of the caudal vena cava and a peritoneal-pericardial diaphragmatic hernia.

Relevance and novel information This study provides further description of the imaging findings in feline patients with fused renal ectopia. The morphologic characteristics of the fused kidneys in cats appear similar to what is published in the human literature. Renal fusion might be an incidental finding in cats, but further investigations are necessary to determine their clinical relevance.

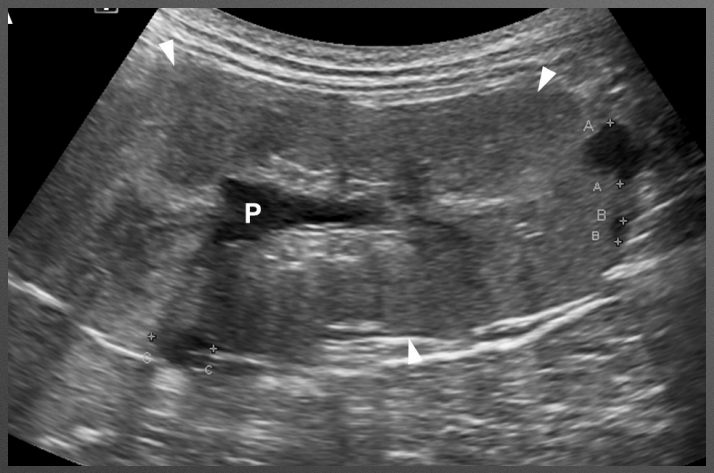
Powell T Slinkard, Augstina Anson, Swan Specchi, Maria Frau Tascon,
Laura Muñiz-Moris , Dominique Penninck and Nele Eley Ondreka

JFMS 2023

Classification

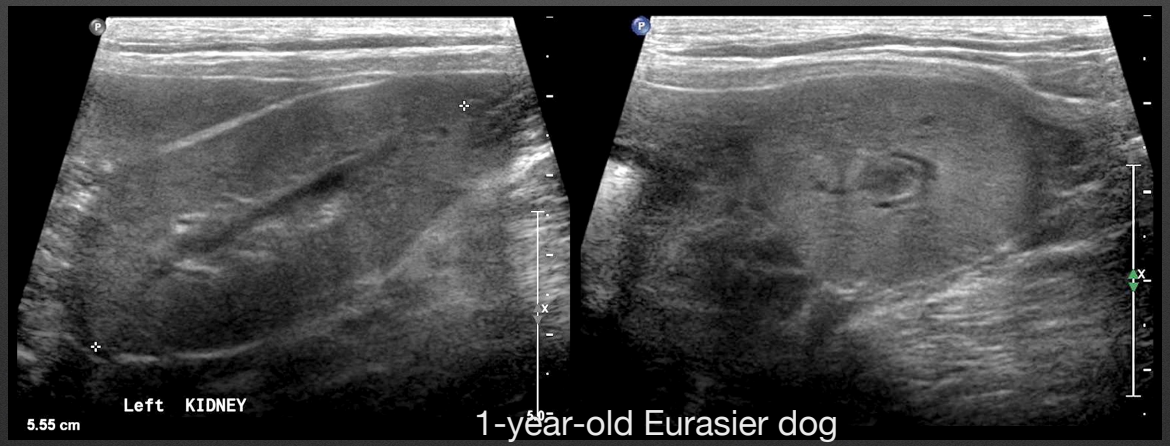


Shape & size: Renal Dysplasia



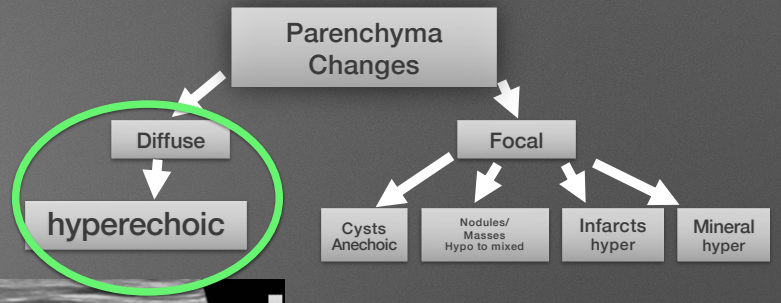
10-month-old Labrador retriever, bilateral dysplasia

Adult mixed-breed dog, unilateral dysplasia

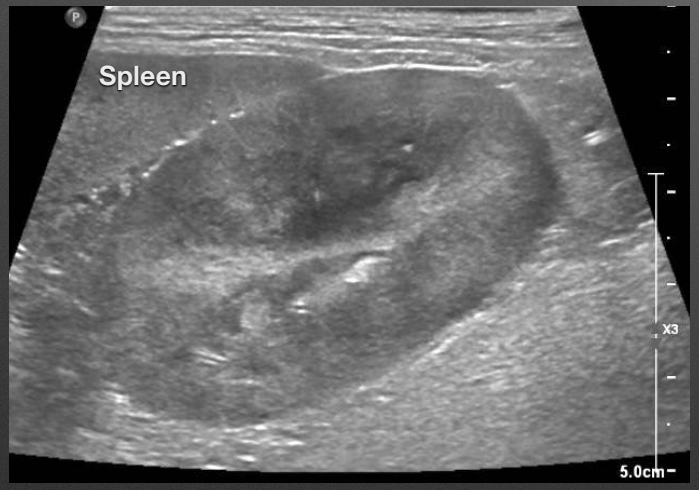


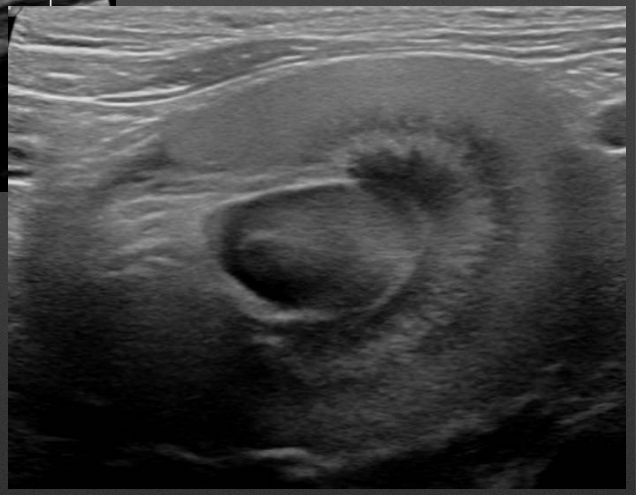
1-year-old Eurasier dog

Diffuse Hyperechogenicity



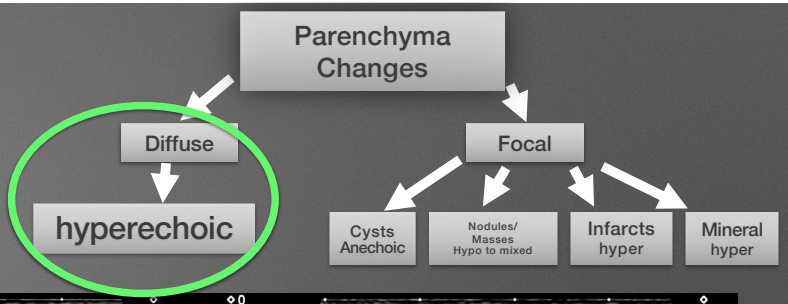
Comparison to adjacent spleen or liver

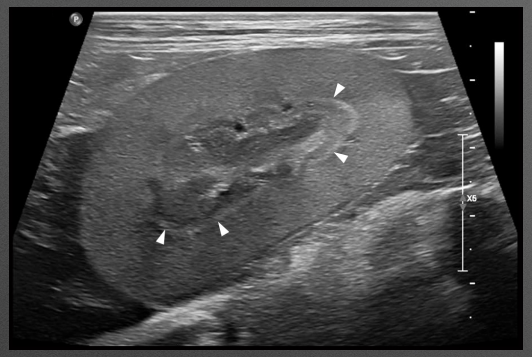




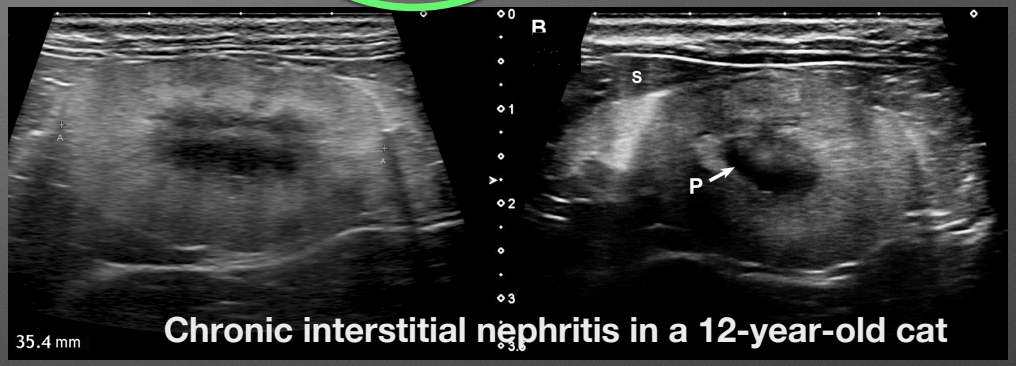
14-year-old cat with heart disease and normal renal values

Diffuse hyperechogenicity

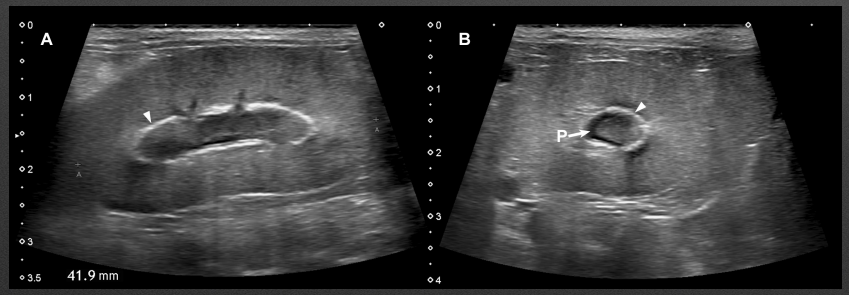




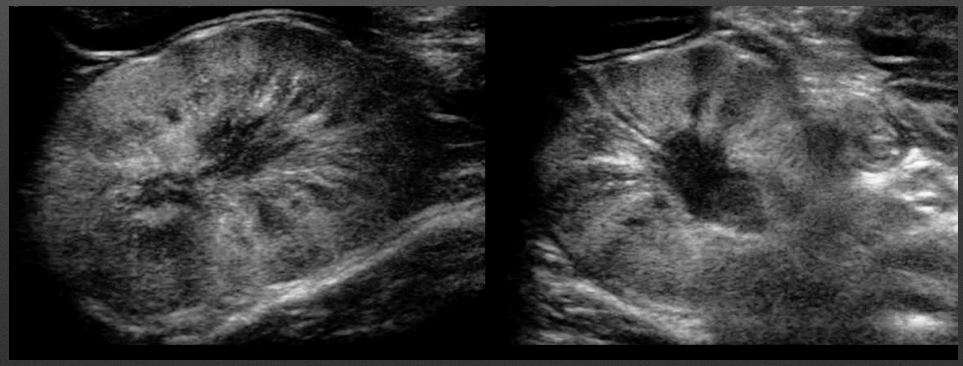
Ethylene glycol toxicity in a 9-year-old Yorkie



Chronic interstitial nephritis in a 12-year-old cat



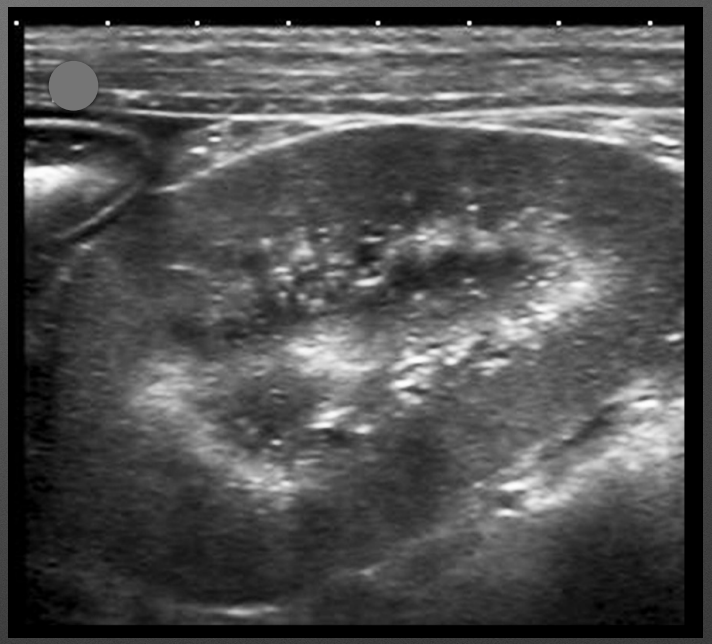
Chronic renal disease in a 11-year-old small dog with creatininemia and proteinuria



Renal tubular lipidosis + lymphocyticplasmacytic interstitial nephritis in a 6-year-old cat with 6-month of azotemia

Nephrocalcinosis

left kidney of a 2-year-old dog
(previous leptospirosis)



Medullary Rim Sign

RENAL MEDULLARY RIM SIGN: ULTRASONOGRAPHIC EVIDENCE OF RENAL DISEASE

DAVID S. BILLER, DVM,[1] GREGORY A. BRADLEY, DVM,[2] BETH P. PARTINGTON, DVM, MS[1]

An echogenic line in the outer zone of the renal medulla, paralleling the corticomedullary junction is described as the renal medullary rim sign. This renal ultrasonographic change is demonstrated in 4 dogs and 2 cats with a range of renal diseases. The renal medullary rim sign provides additional ultrasonographic criteria indicating primary renal disease in some patients. However the renal medullary rim sign may prove to be a poor correlate for prognosis across the range of differentials present in these clinical patients. *Veterinary Radiology & Ultrasound ... 1992, pp 286–290.*

MOST DOGS WITH MEDULLARY RIM SIGN ON ULTRASONOGRAPHY HAVE NO DEMONSTRABLE RENAL DYSFUNCTION

PANAGIOTIS MANTIS, DVM, CHRISTOPHER R. LAMB, MA, VETMB

The medullary rim sign is a distinct hyperechoic line in the renal medulla parallel to the corticomedullary junction that has been reported in dogs with a variety of renal diseases. To examine the association between medullary rim sign and renal disease, the medical records of thirty-two dogs that had medullary rim sign were reviewed retrospectively. Eighteen dogs (56%) had no evidence of renal dysfunction; 14 (44%) had clinicopathological evidence of renal disease, including 6 (19%) that had hypercalcemic nephropathy. Most dogs (72%) in which medullary rim sign was the only ultrasonographic finding affecting the kidneys had no evidence of renal dysfunction. In contrast, 78% dogs that had medullary rim sign and other renal signs (reduced size, increased medullary echogenicity, and pyelectasia) had renal disease. On the basis of this study, the medullary rim sign appears to be a non-specific ultrasonographic sign; however, the possibility cannot be excluded that is a sentinel sign of subclinical renal disease. *Veterinary Radiology & Ultrasound, Vol. 41, No. 2, 2000, pp 164–166.*

ULTRASOUND APPEARANCE OF THE OUTER MEDULLA IN DOGS WITHOUT RENAL DYSFUNCTION

DANIEL VANDER HART, MATTHEW D. WINTER, JULIE CONWAY, CLIFFORD R. BERRY

Ultrasound findings of the canine kidney include a hyperechoic cortex and a hypo to anechoic medulla. In this study, the sonographic appearance of the outer renal medulla in dogs without evidence of renal disease is described. Dogs that underwent abdominal ultrasound over a 6-month period were subjected to review and then divided into six groups based on body weight (kg): < 4.9, 5.0–9.9, 10–19.9, 20–29.9, 30–39.9, and ≥ 40. Chi-square analysis was used to determine if the frequency of a hyperechoic outer medulla was significantly different between weight groups, sex, and age (*P*-value < 0.05). Of the 145 dogs that met the inclusion criteria, 45 had a hyperechoic outer medulla relative to the cortex and inner medulla. In the remaining dogs, the outer medulla was isoechoic to the cortex. Dogs less than 5 kg had the highest frequency of a hyperechoic outer medulla ($P < 0.0001$) and dogs greater than 40 kg did not have a hyperechoic outer medulla ($P < 0.0001$). Sex had no influence on the presence or absence of the hyperechoic outer medulla; however, younger dogs were overrepresented (6.4 ± 0.6 years compared with 7.8 ± 0.4 years; $P = 0.04$). Ultrasound descriptions of the canine kidney have not taken into account the contributions of the renal cortex and outer medulla. Based on this study of dogs with no clinically significant renal disease, the outer medulla can be isoechoic or hyperechoic to the cortex and a hyperechoic outer medulla is more commonly seen in small breed dogs. © 2013 *Veterinary Radiology & Ultrasound.*

The ultrasonographic medullary "rim sign" versus medullary "band sign" in cats and their association with renal disease

Abstract

Background: Medullary rim sign (MRS) refers to a hyperechoic line in the renal medulla, reported on ultrasound examination (US) in both dogs and cats with and without kidney disease (KD).

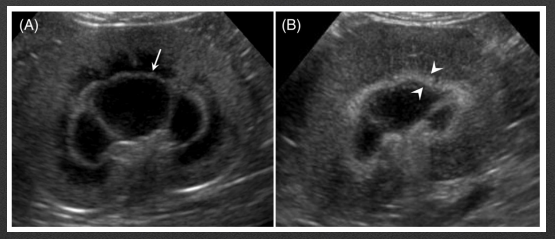
Objective: To describe the different aspects of MRS in cats and to assess its association with KD.

Animals: Cats that underwent US examination, with MRS (study group) with and without KD and without MRS with and without KD (control groups).

Methods: Retrospective case-control study: cats with MRS, with or without KD (rim sign groups) and cats without MRS, with or without KD (control groups). Ultrasonographic images were blindly reviewed with attention given to the thickness and margins of the MRS recorded.

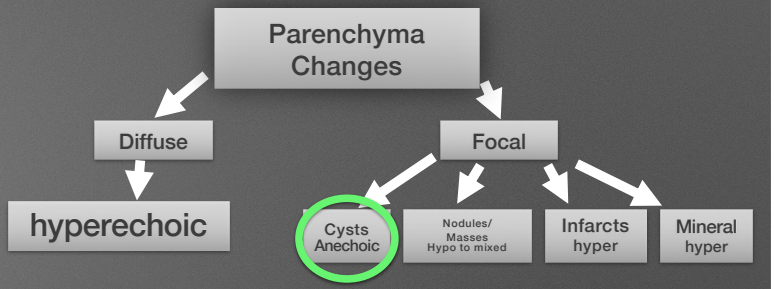
Results: Eighty-four cats with MRS were included and 60 cats recruited for each control group. The MRS had 2 distinct aspects: a thin hyperechoic line with well-defined margins (MRS-*line*) in 50/84 cats (59%) and a thick hyperechoic band with ill-defined margins (MRS-*band*) in 34/84 cats (41%). Twenty of 50 (40%) cats with MRS-*line* and 25/34 (74%) of cats with MRS-*band* had KD. The frequency of MRS-*line* was higher in cats without KD, whereas the presence of MRS-*band* was more frequent in cats with KD (P = .003).

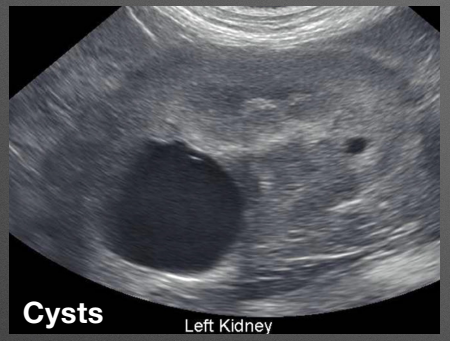
Conclusions and Clinical Importance: A thick hyperechoic ill-defined band (for which the term medullary band sign is proposed) was more frequently associated with KD, whereas a thin hyperechoic well-defined line (true MRS) may be seen in cats with or without KD.



Cordella A. et al JVIM 2020;34:1932–1939.

Focal: cysts

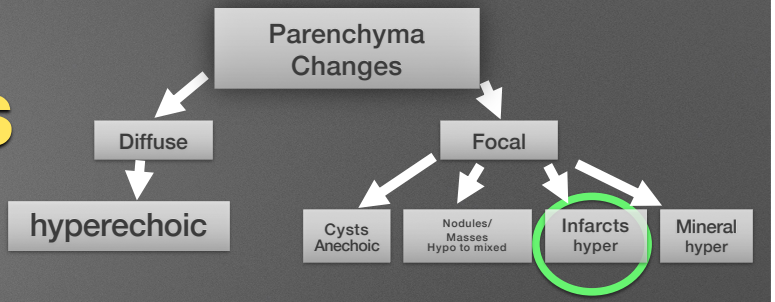




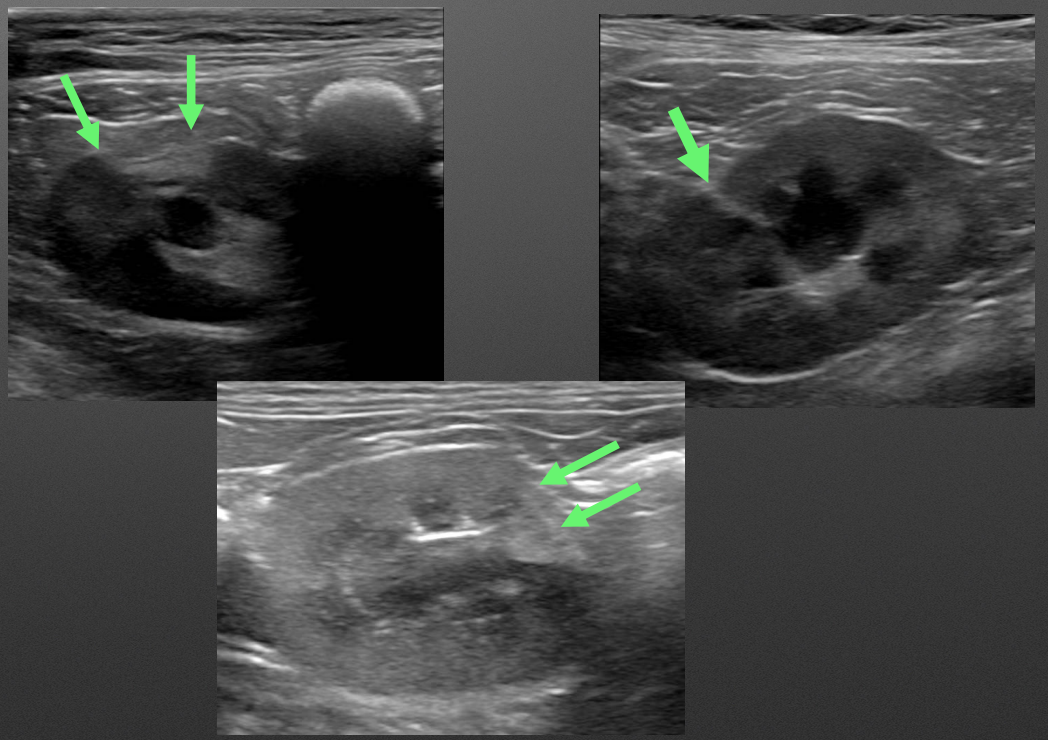
Polycystic kidney disease

- Thin walled
- Anechoic center
- Complicated cysts may have echogenic contents
- Far enhancement
- Single or multiple

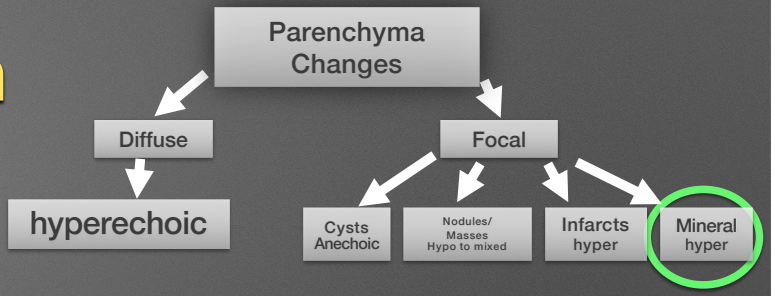
Focal: infarcts



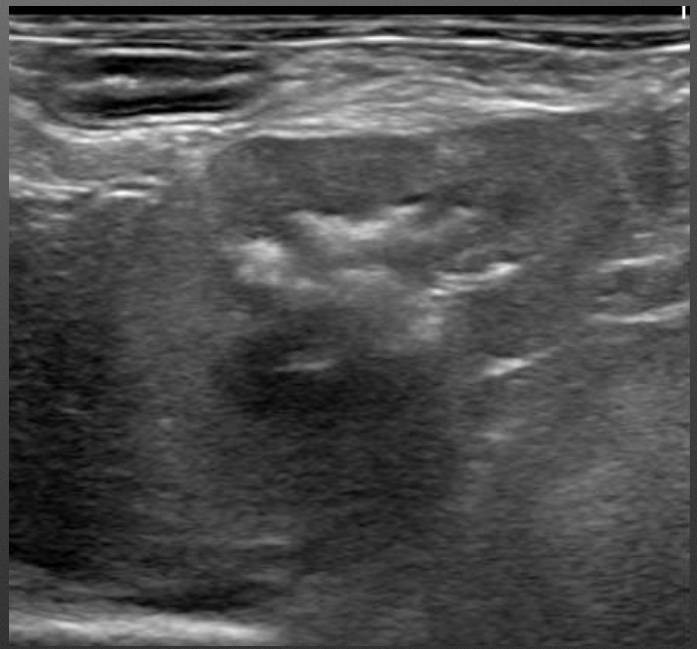
- Along renal cortex
- Hyperechoic
- Linear or wedge-shaped
- Indentation of capsule



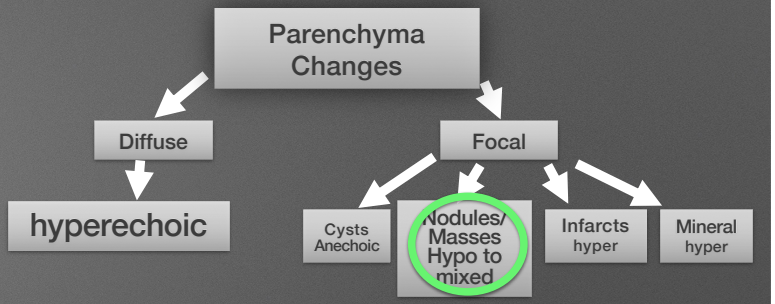
Focal: Fibrosis/mineralization



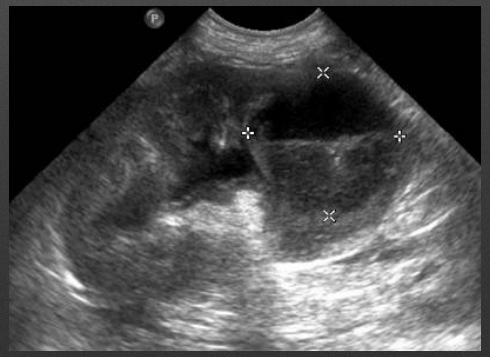
- Along renal cortex or medulla
- With or without shadowing
- Punctated or linear



Focal: nodules/masses



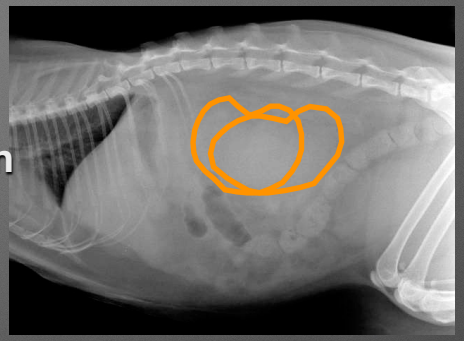
- May be hyper-, hypo- or isoechoic or mixed echogenicity
- May deform the renal contour, +/- involve pelvis
- US appearance non specific

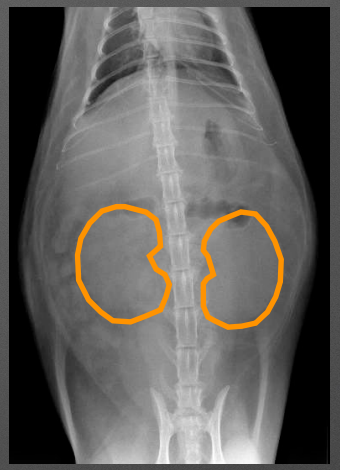


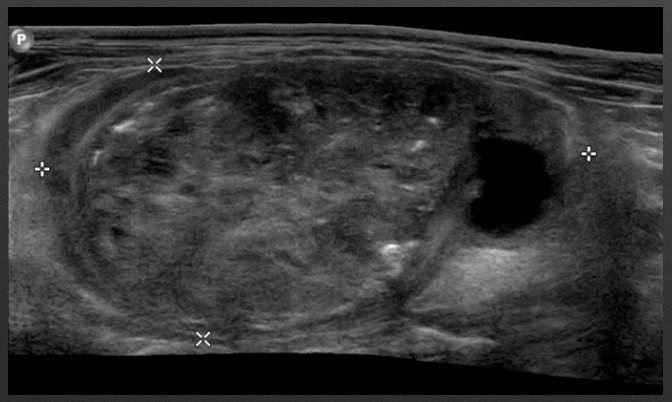
Abscess and carcinoma

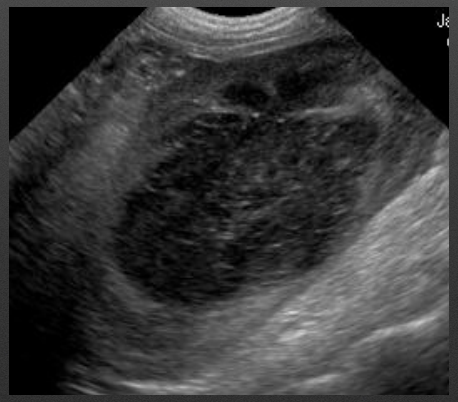
Renomegaly or Mass?

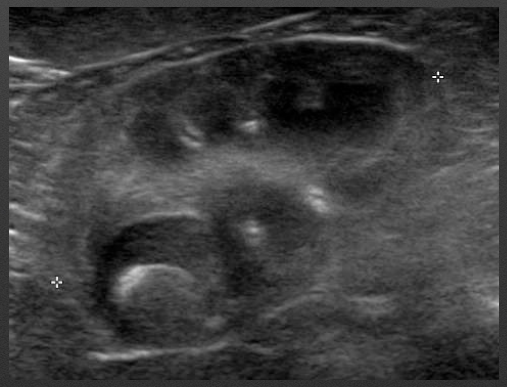
- Enlargement/deformity of the kidney with alteration of its normal shape/architecture
- The lesion is usually solid in nature but may have cystic component
- May or may not affect the collecting system



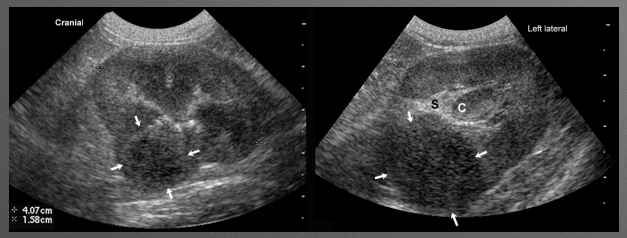




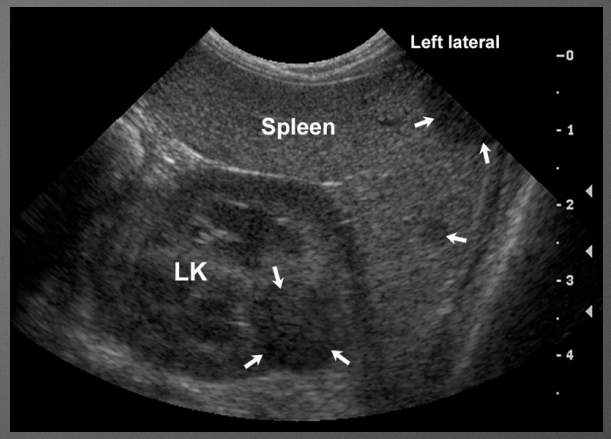




Renal Nodules

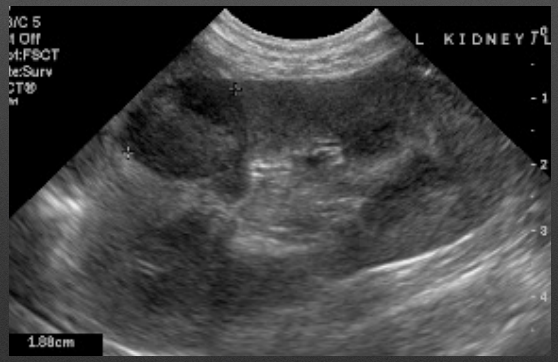


LK, Lhasa Apso: lymphoma

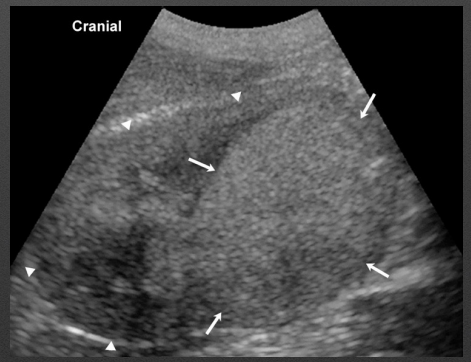


LK, mix dog: malignant histiocytosis

LK, cat: metastatic carcinoma (primary in lung)



Metastasis-histiocytic sarcoma



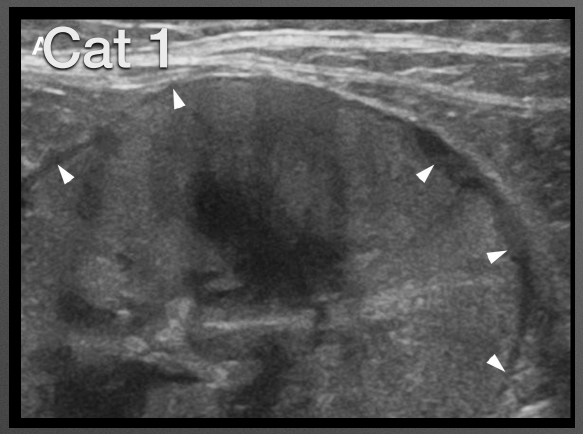
LK, dog: renal adenocarcinoma

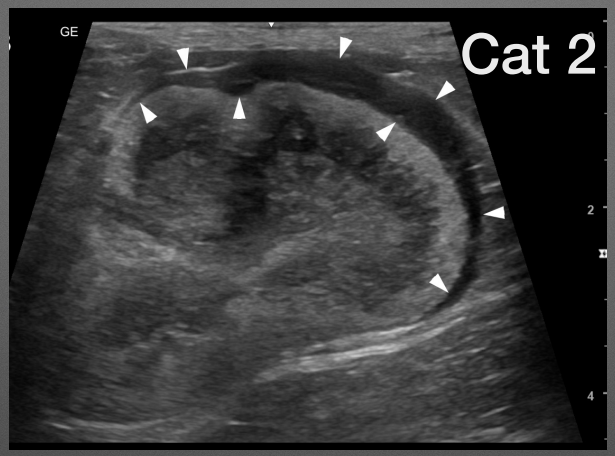
Renal Nodules & Masses: Tumors

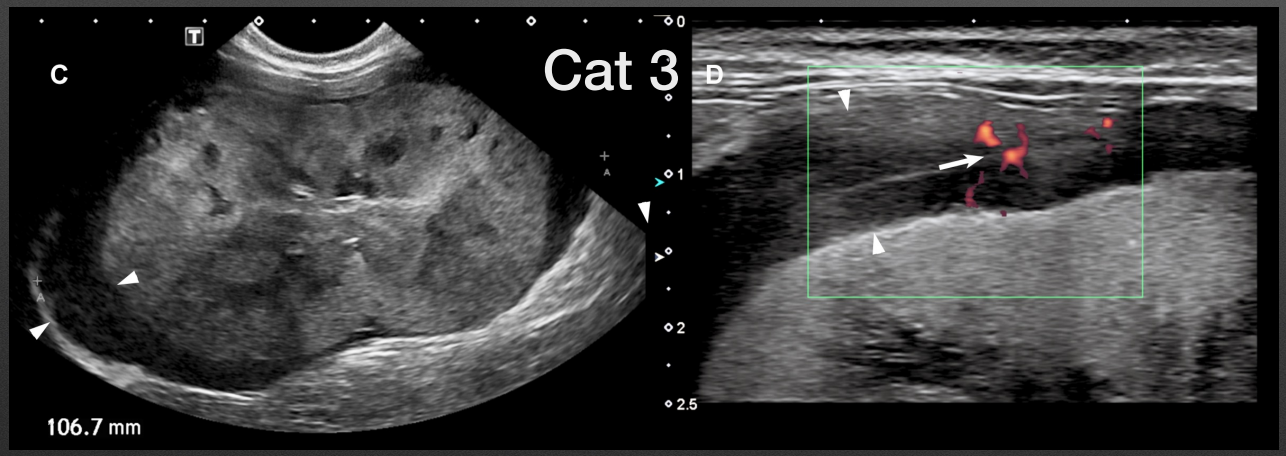
- ★Carcinoma (adeno-, transitional-,squamous-)
- ★Lymphoma
- ★Hemangioma/sarcoma
- ★Metastasis/multicentric tumor
- ★Nephroblastoma (rare, congenital)

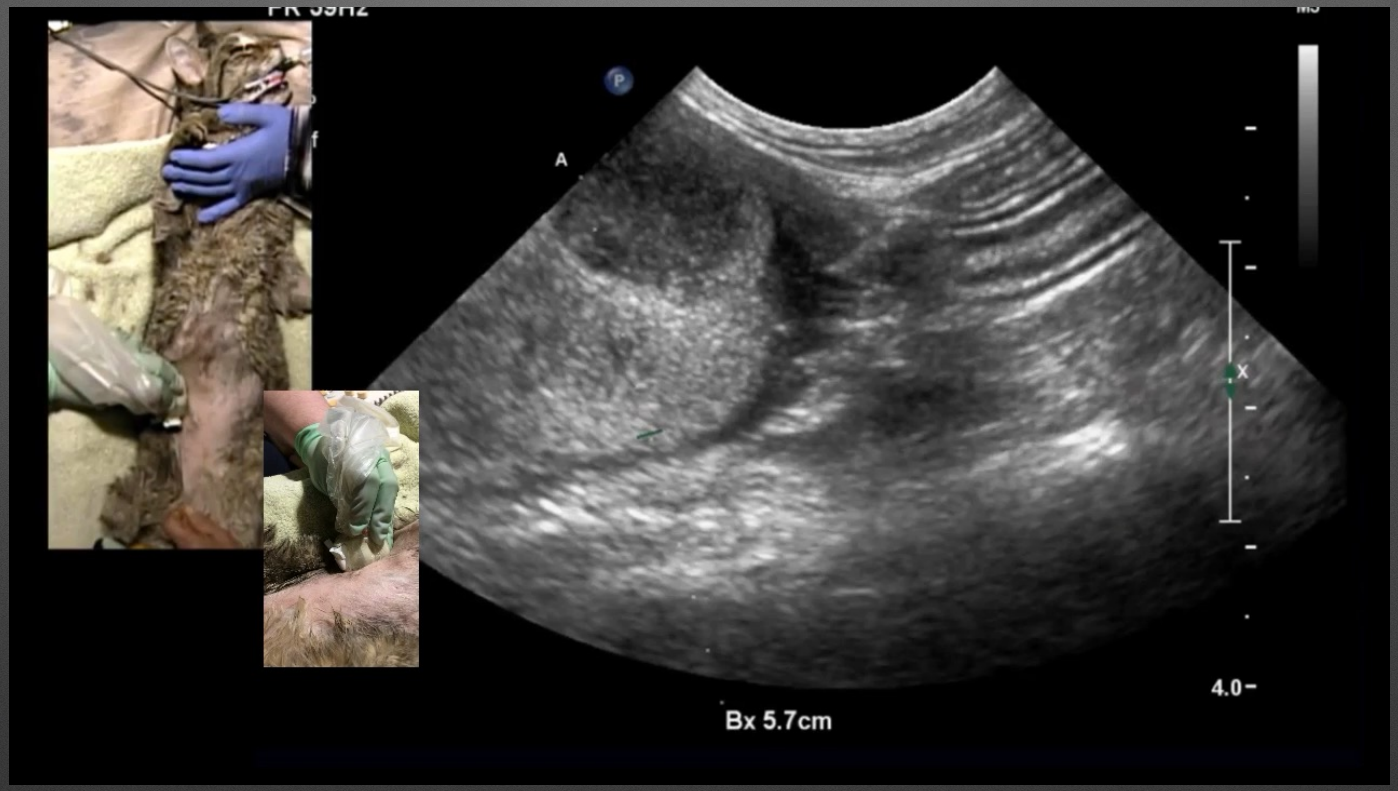
Lymphoma

Lymphoma







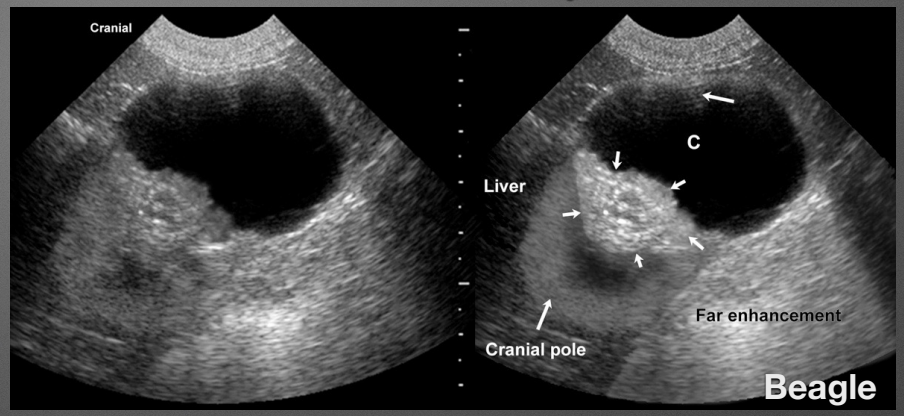

A
4.0
Bx 5.7cm

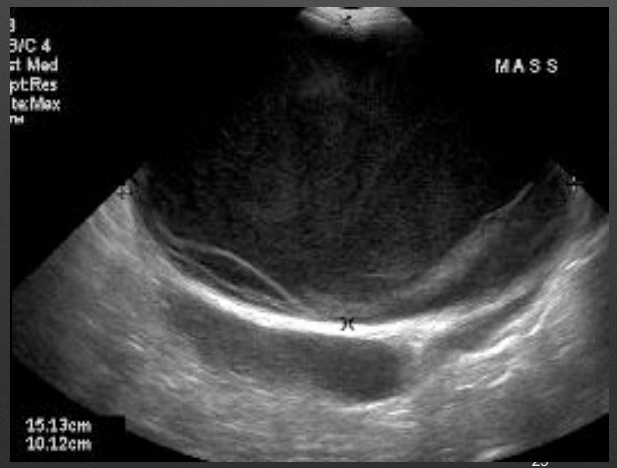
Hemangiosarcoma

Cystic Tumors

Severe hydronephrosis and mass:
soft tissue sarcoma

Cystadenocarinoma





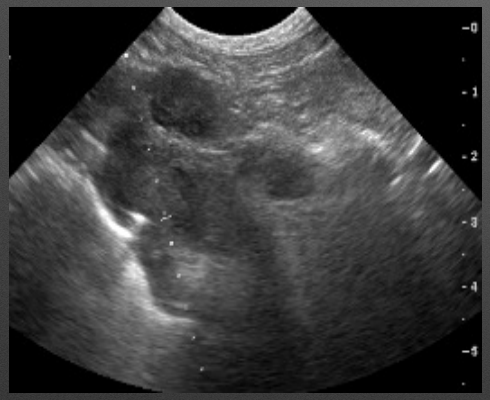
Cystic TCC
Beagle

Other nodules

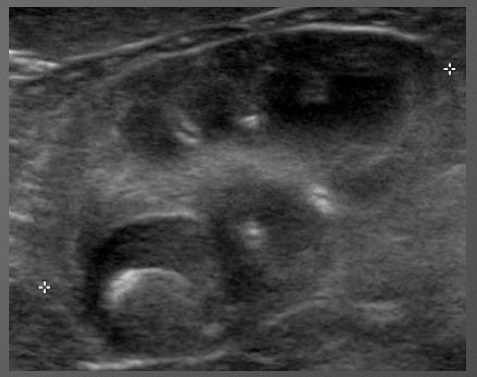
Boxer, 9-year-old,
vomiting and anorexia

Peke/x 9-year-old,
vomiting, heart murmur,
normal blood work

Outcome



Numerous lesions in stomach, lymph nodes, kidneys
FNA: round cell neoplasia, histiocytoma?



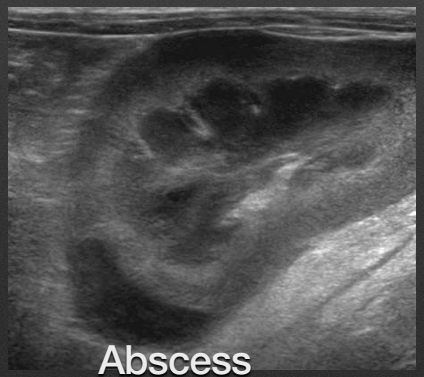
FNA: necrotic tissue
6 months recheck unchanged

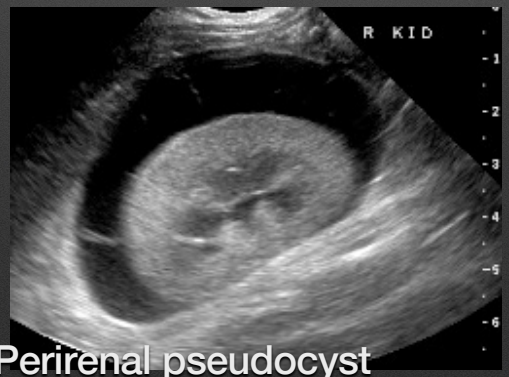
Non-Tumoral Changes

★ Focal nodule(s): complicated cyst, abscess, granuloma

★Peri-renal pseudocysts, PKD

★ Pyonephritis (extending within the collecting system)


Abscess



Perirenal pseudocyst

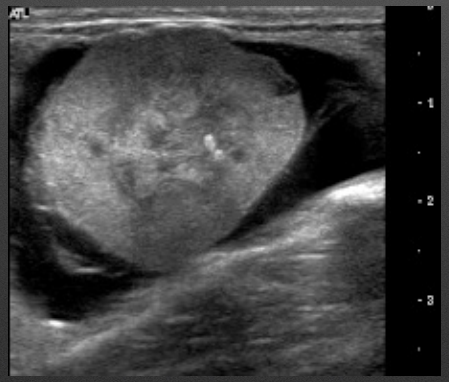
PKD

Perirenal Pseudocysts

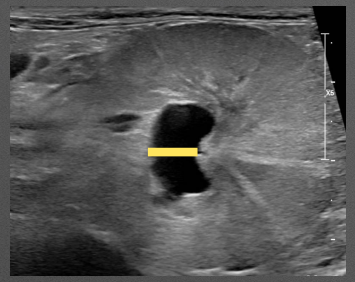
- older (often male) cats, uni- or bilateral
- transudate fluid
- Subcapsular (or extracapsular) fluid accumulation
- Sac made of fibrous connective tissue

(usually not secreting epithelium)

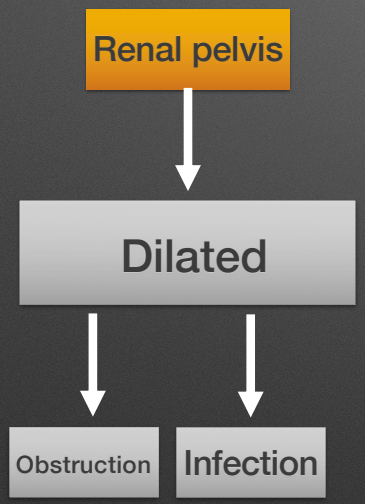
- Etiology? Obstruction of lymphatic drainage of the renal capsule?
- Surgical resection of the capsule



5.3 cm long kidney-SCC



Collecting system



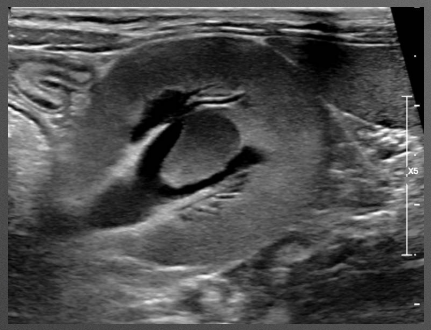
Pyelectasia**—> ***dilation of the renal pelvis of a kidney

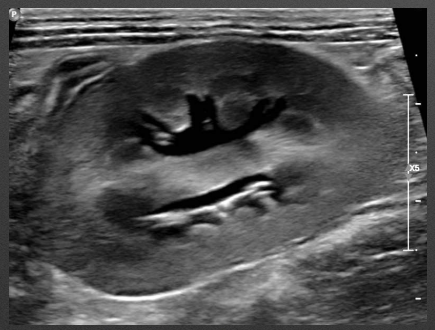
Pyelonephritis**—> ***inflammation of both the renal parenchyma and the lining of the renal pelvis (often bacterial infection)

Hydronephrosis**—> cystic distension of the kidney caused by the accumulation of urine in the renal pelvis as a result of ***obstruction to outflow and accompanied by atrophy of the kidney structure and cyst formation

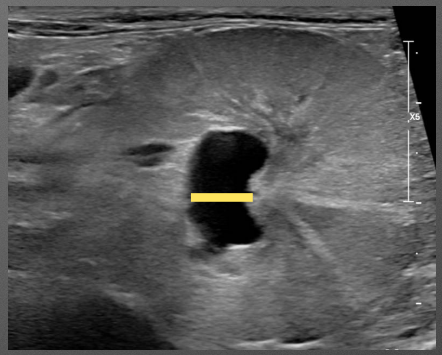
Pyonephrosis**—> is an ***infection of the renal collecting system. Pus collects in the renal pelvis and causes distension of the kidney.

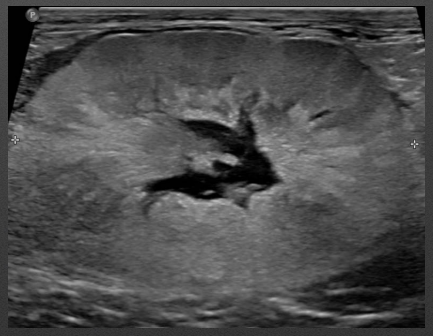
Renal Pelvis: how dilated is too dilated?





- Mild
  - Back pressure (full bladder)
  - Diuresis / polyuria
- Clinically significant
  - Pyelonephritis
  - Obstruction (hydronephrosis)



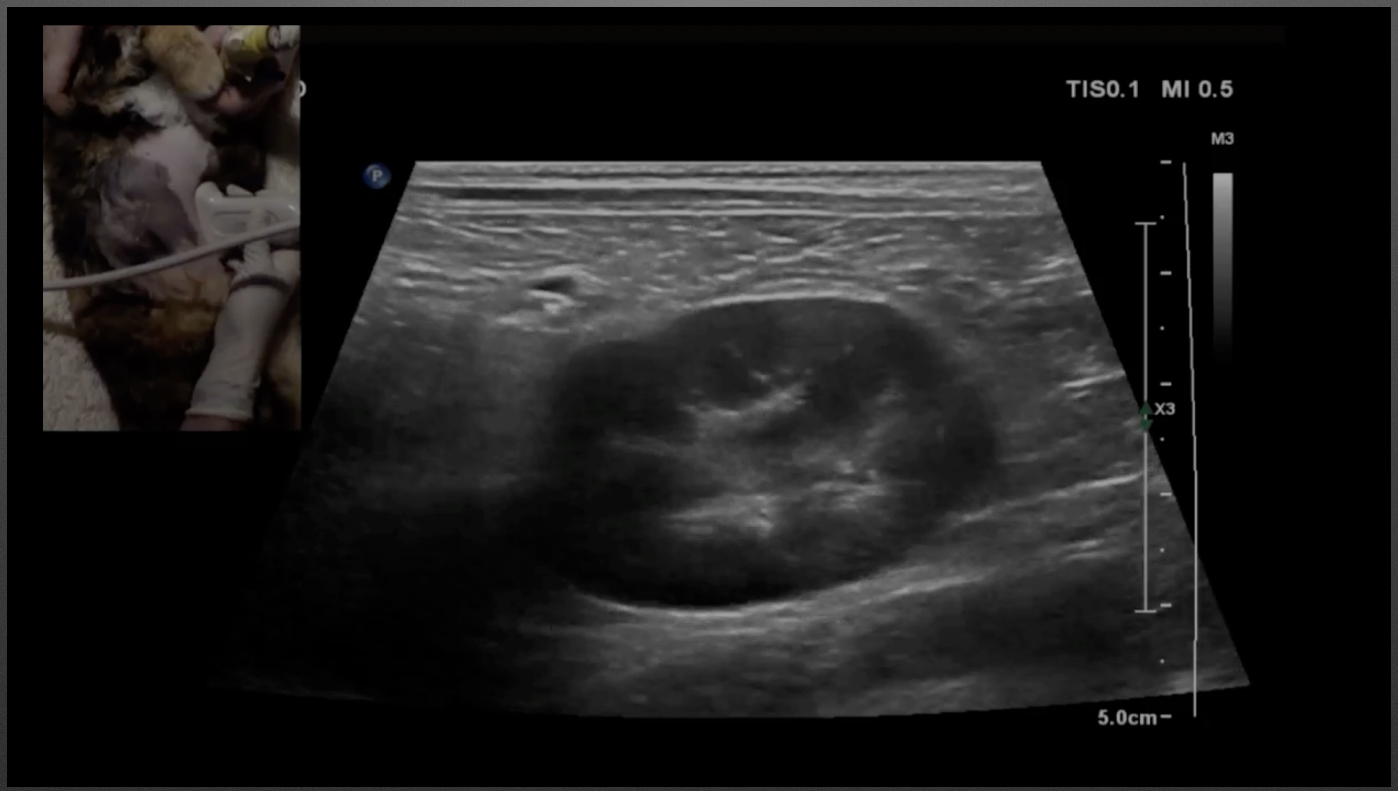


Moderate to severe pelvic dilation

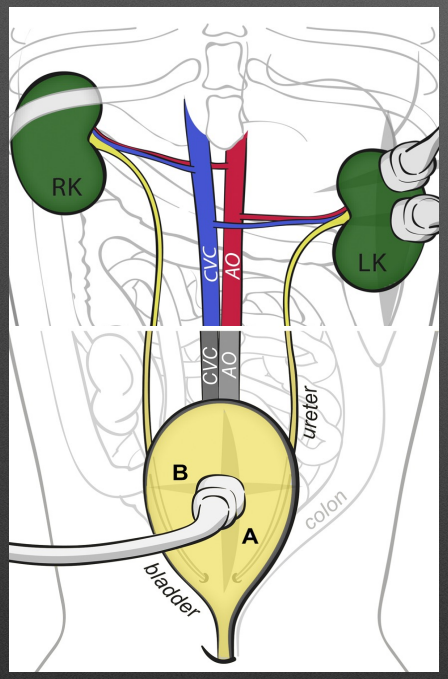
- Need to rule out obstruction
- Intraluminal
  - Calculus
  - Blood clot
  - tumor/granuloma
- Extraluminal
  - Mass
  - Spay (accidental ureteral ligation)

Pyonephrosis

11-year-old cat with anorexia, lethargy and fever. Elevated BUN, creatinine.
3+ toxic changes on CBC despite being on AB



US features of Ureteral Lesions



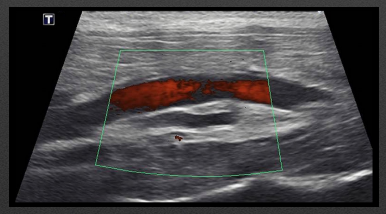
Normal ureters barely seen

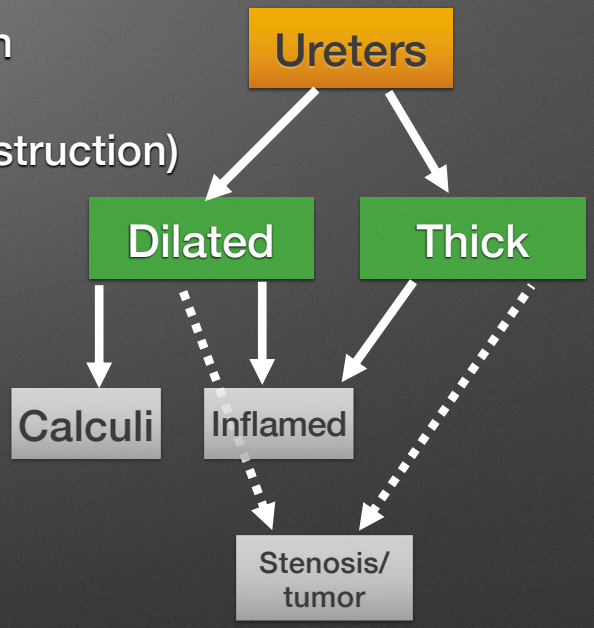
Dilation (ectopia, inflammation, obstruction)

Wall thickening

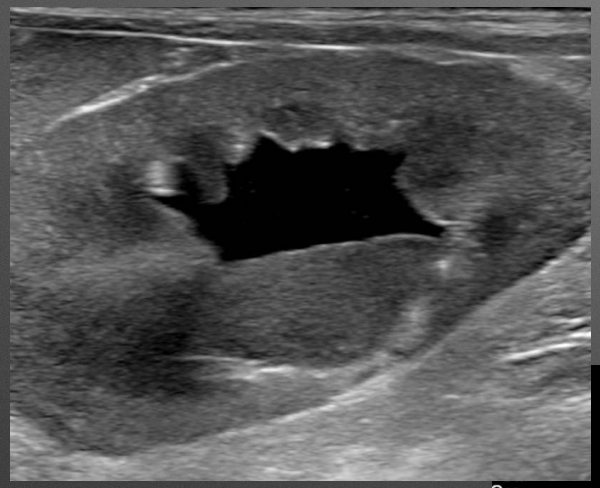
Tumors

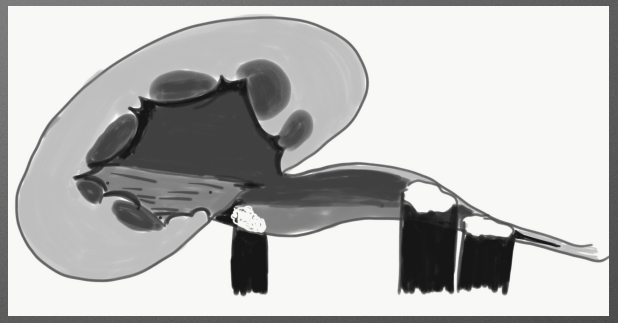
Content

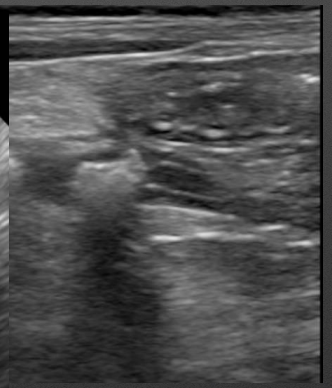




Ureteritis







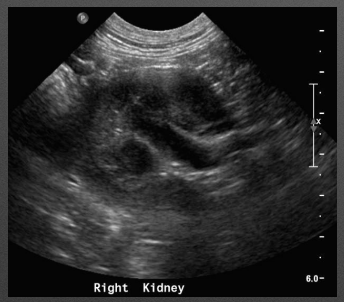
Pyonepritis and ureteritis

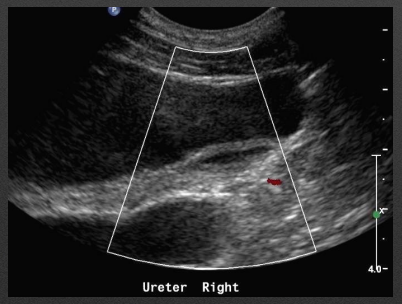
Ectopic Ureter

A 14-month-old Female (intact) Labrador has persistent urinary incontinence and chronic urinary tract infections.

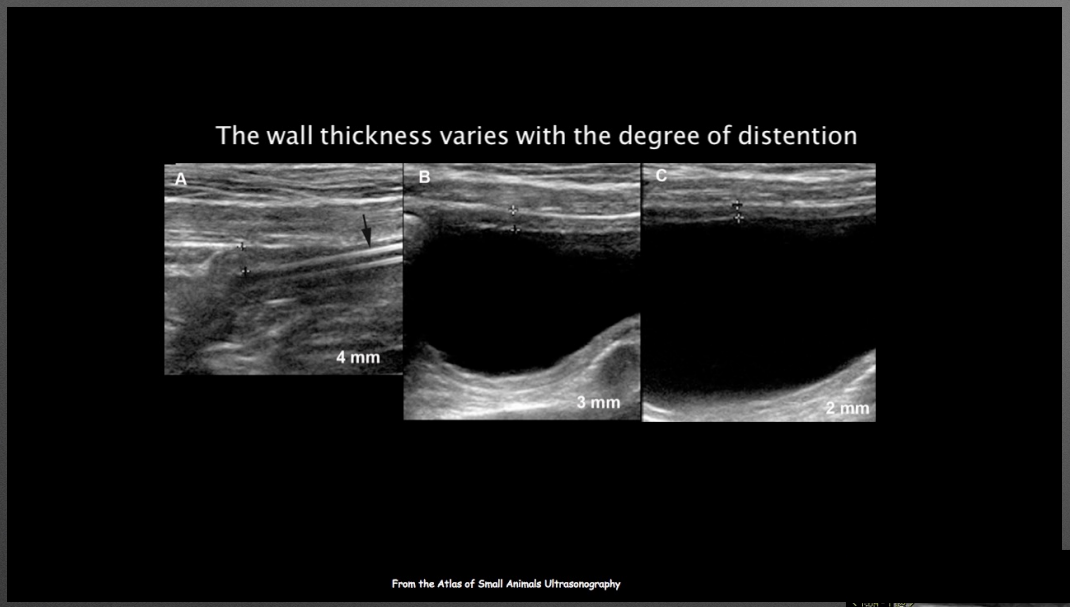
Outcome

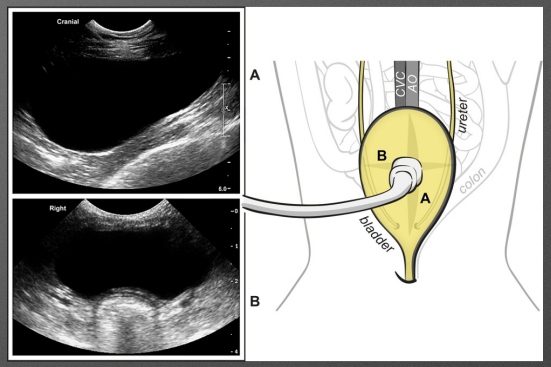
Based on US findings, suspected bilateral ureteral ectopia with hydronephrosis and hydroureters. The distal ureters are suspected to be intramural. Laser-assisted ablation and ovariohysterectomy were recommended.

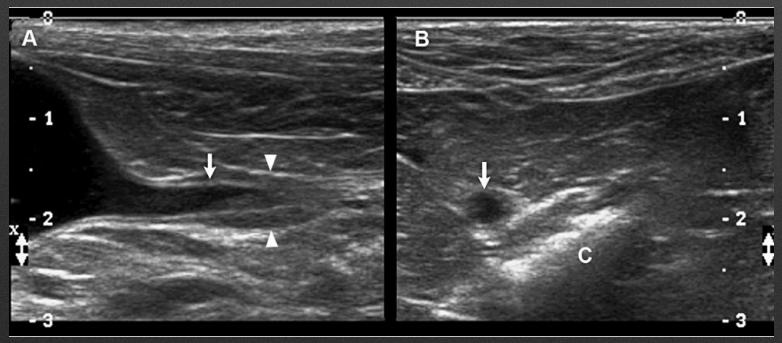


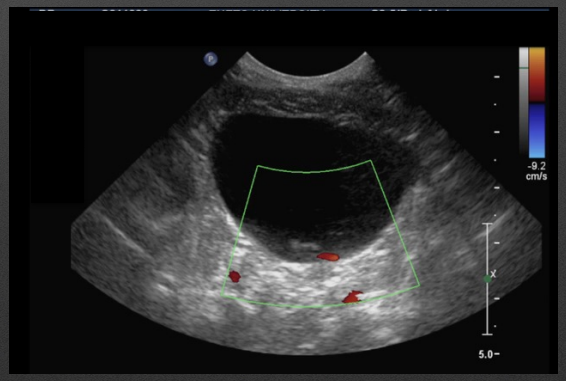


Normal US Anatomy



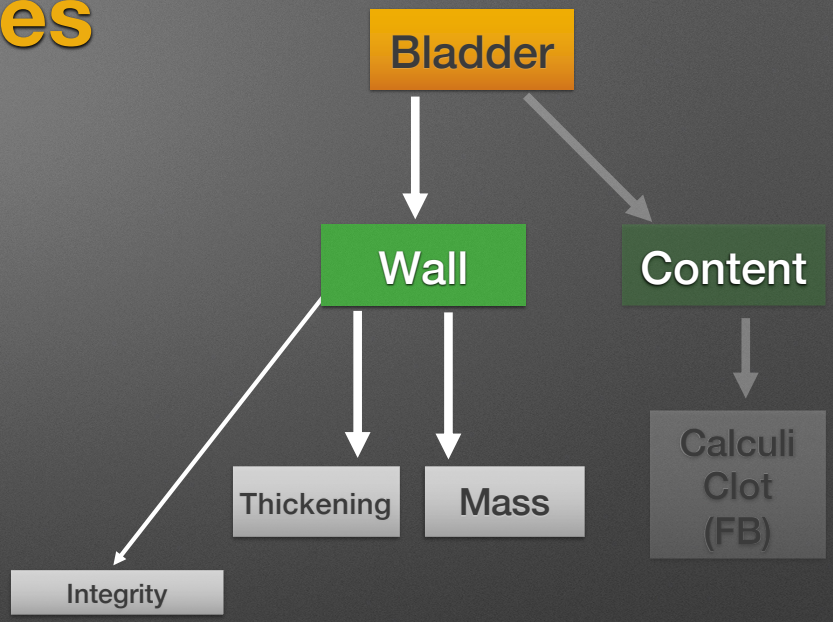




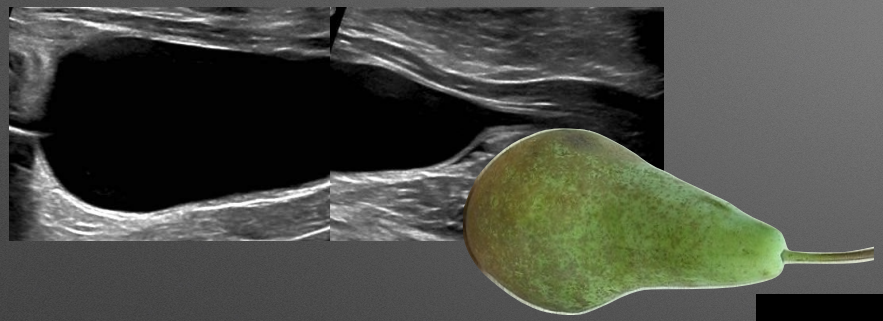


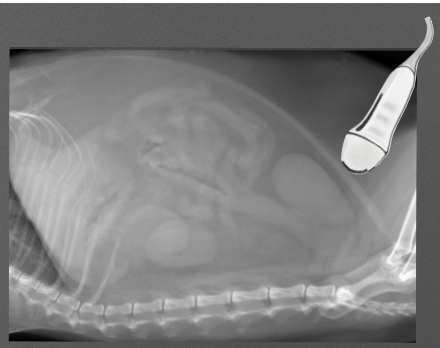
Bladder Wall Changes

- Bladder location and shape
- Thickness: focal versus diffuse
- Echogenicity: increased, layered?
- Integrity: rupture

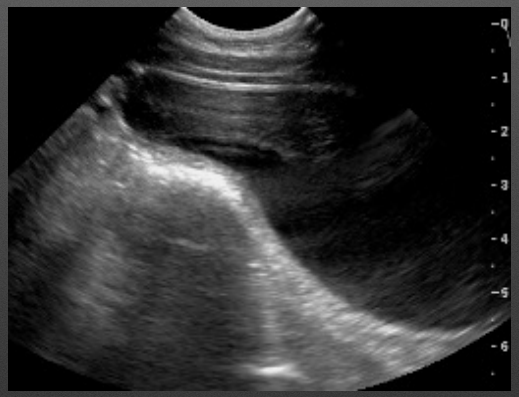


Bladder Location and Shape



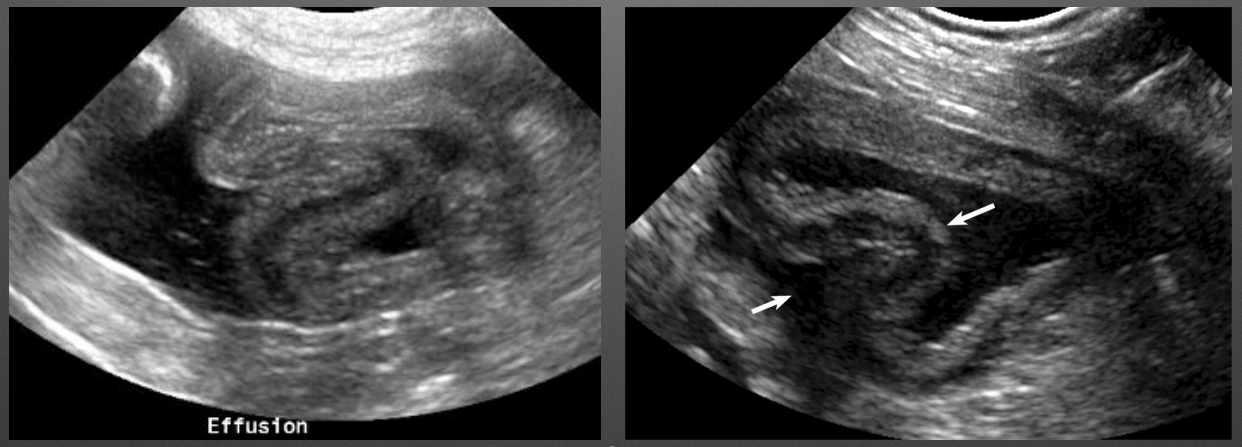


- Pelvic bladder
- Hernia
- Invagination/inversion
- Urachal remnant



Reversed pear shape
Pelvic bladder?

Bladder Inversion

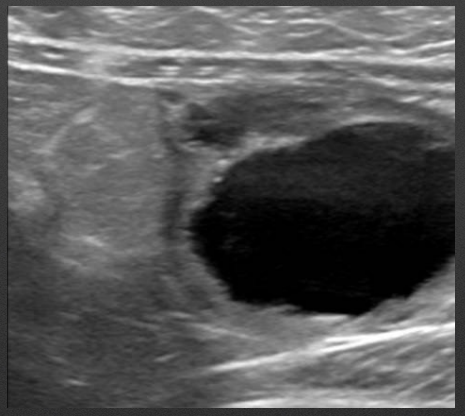


Dog with Chronic cystitis
and numerous catheter placements

Bladder inversion and secondary hematuria in a 6 month old domestic shorthair cat.
Adin CA et al, JAVMA 2011;239:370-373

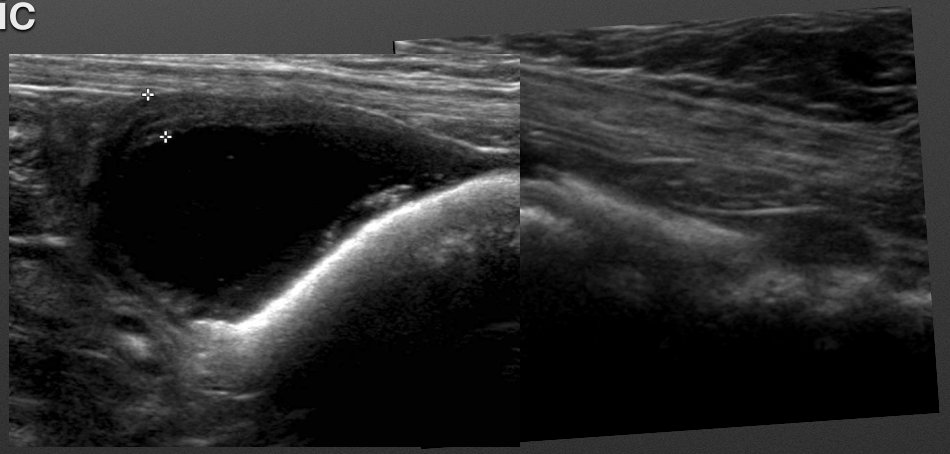
Shape: Urachal diverticulum

7-year-old male cat with recent UO

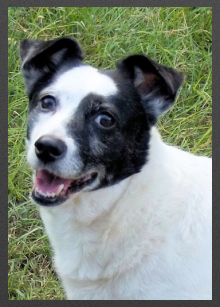


Cystitis

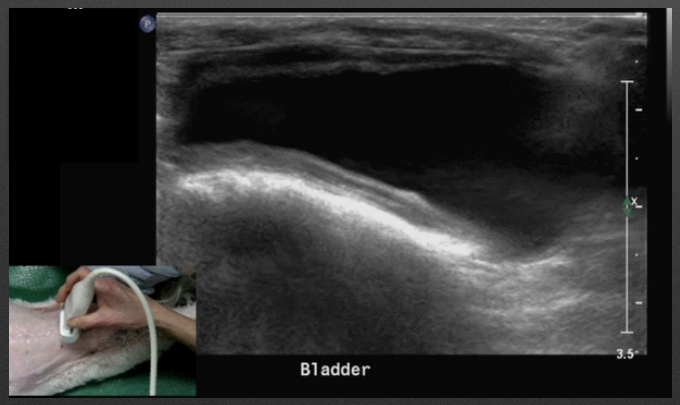
- Wall thickening-mostly cranioventral
- At times, accentuated layered appearance
- Luminal contents: crystals/calculi, sediments, blood clots
- Causes: inflammatory, infectious, idiopathic



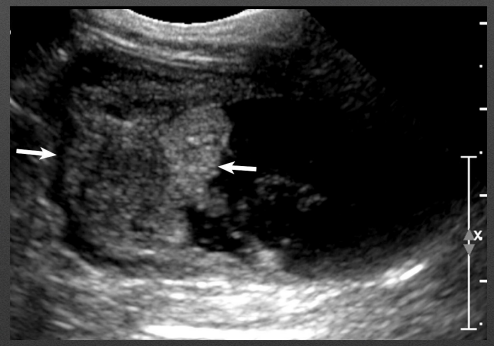
Polypoid Cystitis



11-year-old M Jack Russel Terrier
Stranguria, pollakiuria and hematuria
for 6 weeks (prostatitis)



8-year-old terrier

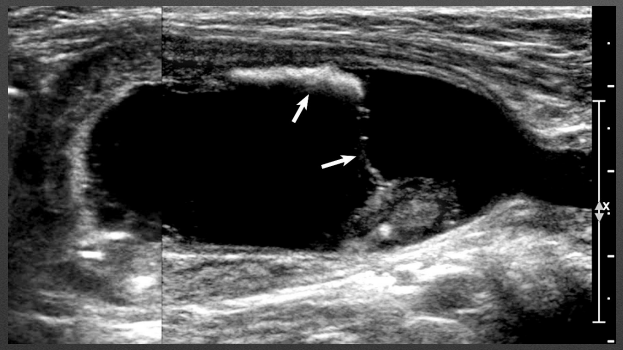


8-year-old Cocker spaniel
sx excision: mucosal polyp

Pseudomembranous Cystitis

2-year-old Chihuahua

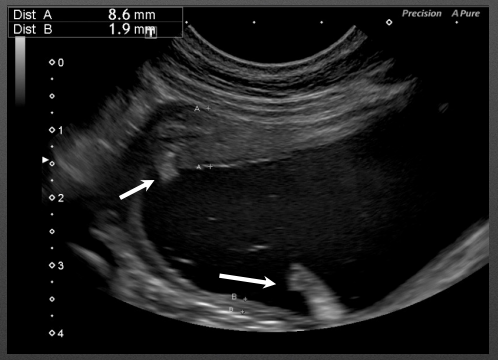
Hematuria and urinary obstruction

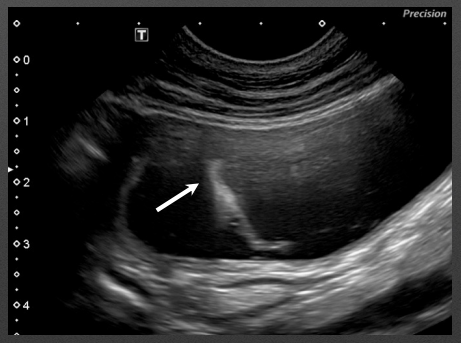


Mycoplasma and other bacteria

5-year-old F Chow Chow

Hematuria and dysuria
Inability to urinate





Pseudomembranous cystitis: An uncommon US appearance of cystitis on dogs and cats

Abstract: In veterinary medicine, pseudomembranous cystitis (PC) is a rare condition described only in cats. The purposes of this retrospective study were to describe ultrasound features of PC in cats and dogs, predisposing factors, comorbidities and outcomes. Cats and dogs with an ultrasonographic diagnosis of PC were included in the study. The bladder ultrasound findings that were recorded were: pseudomembranes' characteristics, abnormalities of the bladder's wall and content and anomalies of the pericystic peritoneal space. Ten cats and four dogs met the inclusion criteria. Four pseudomembrane adhesion patterns were described. The presence of pseudomembrane acoustic shadowing was observed in the 60% of cats. A total of 80% of the cats included were presented for urethral obstruction (UO) and/or had at least one episode of UO in the previous 2 months. Thirteen patients out of fourteen received only medical therapy, and all of them survived. PC is a rare disorder in cats and dogs and there are some ultrasonographic differences between the two species, suggesting a greater severity of the pathology in cats. Chronic cystitis and UO may have a potential role in the development of feline PC. Finally, the medical approach can be a non-invasive and effective approach for PC.

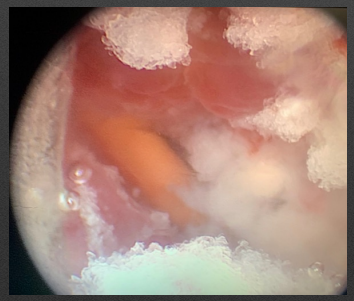
Pucinelli C et al, 2021, Vet Science

Encrusting cystitis in a cat secondary to Corynebacterium urealyticum infection

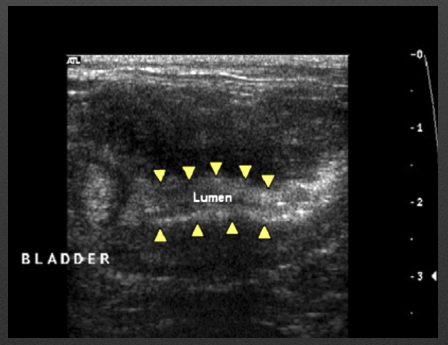
An 18-year-old male neutered domestic shorthair cat was presented for haematuria and lethargy. The cat had sustained a traumatic T3-L3 lesion 5 years prior resulting in upper motor neuron incontinence. On further investigation the cat was found to be hyperkalaemic, hypothermic and dehydrated.

US revealed a markedly hypoechoic, thickened bladder wall with an irregular, hyperechoic mucosal layer. The patient responded to symptomatic and supportive care and was discharged. Despite initial improvement, the patient returned 10 days after discharge with recurrence of haematuria and lethargy.

US-guided aspiration and culture of the material on the mucosal surface of the bladder confirmed diagnosis of UTI caused by **Corynebacterium urealyticum**. On post-mortem examination, gross and histopathological features were consistent with encrusting cystitis.

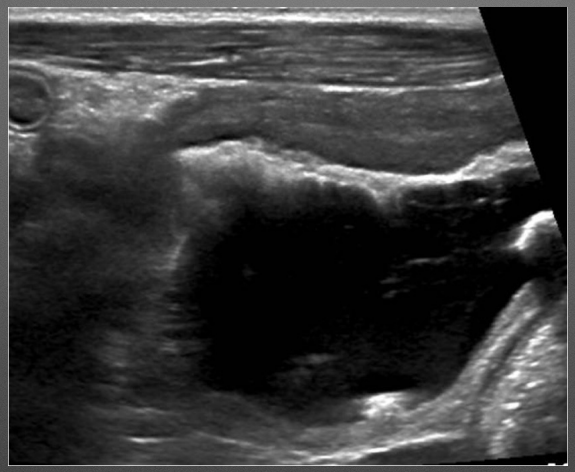


6-year-old cat CM with chronic UTI



Briscoe K et al. Journal of Feline Medicine and Surgery (2010) 12, 972-977

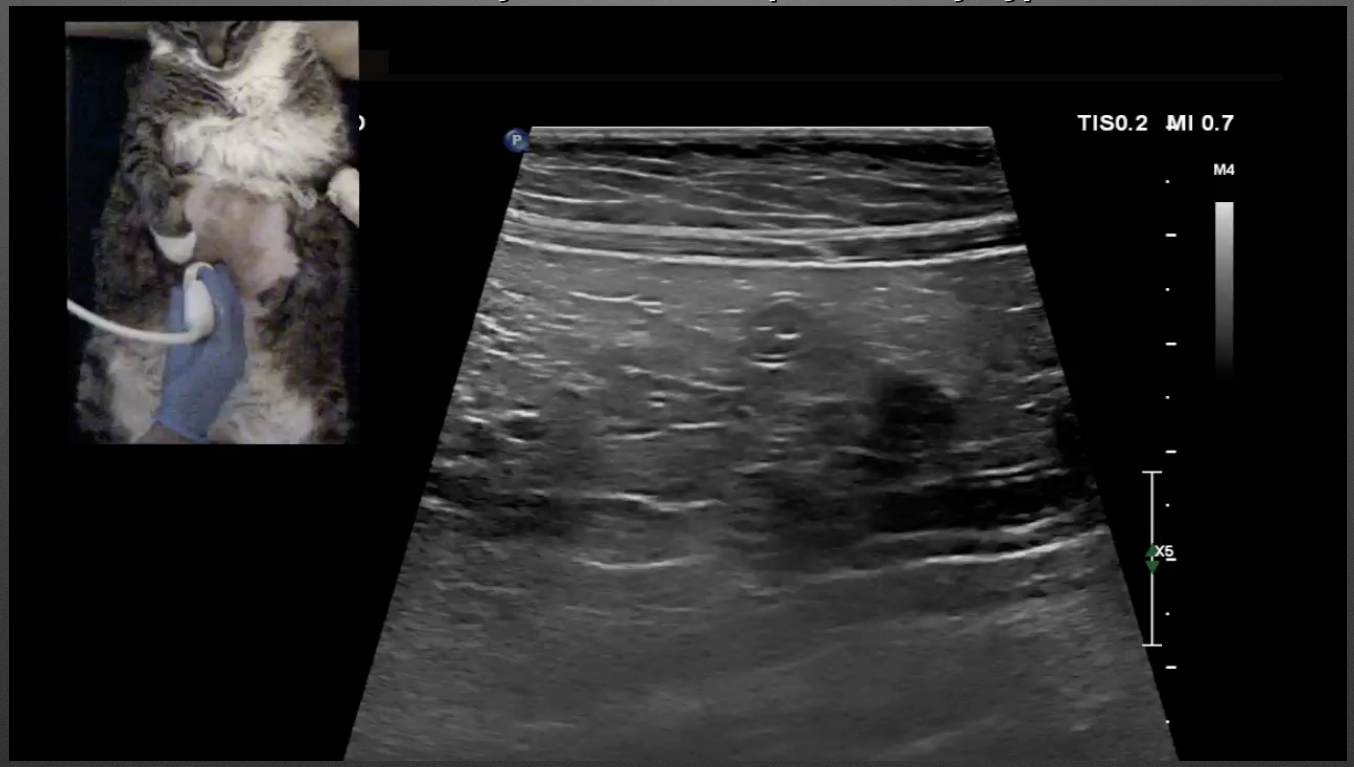
Encrusting cystitis



In this 3-year-old male German shorthair Springer presented for stranguria and recurrent cystitis, **the** ventral bladder wall is markedly thickened (8mm).
Two calculi were also present in the lumen.
Urine culture revealed **Staphylococcus Pseudintermedius** (urease-producing bacteria).

Pseudomembranous & encrusting Cystitis

3-year-old DSH presented one day ago for urethral obstruction. Drops of blood noted by owner. She was unblocked easily but remained persistently hyperkalemic and azotemic.



Pseudomembranous cystitis in cats with presumed or confirmed mineralization: A retrospective study of 26 cases (2016-2021)

Background: Pseudomembranous cystitis (PMC) in cats is a recognized disease, but concurrent mineralization is reported rarely and its outcome is poorly described.

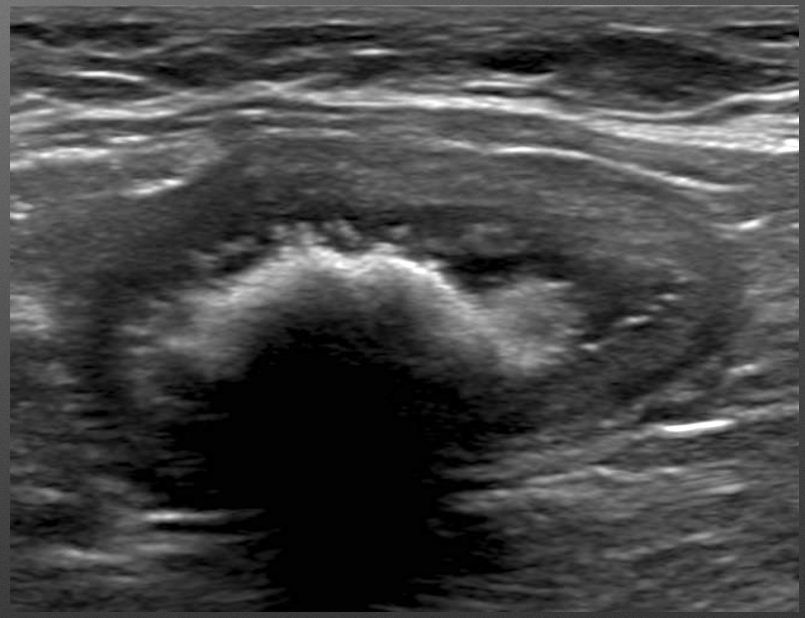
Hypothesis and Objectives: Describe a population of cats with PMC and the prevalence of concurrent mineralization.

Animals: Twenty-six cats with PMC.

Methods: Medical records were retrospectively reviewed (January 2016 to December 2021). Cats with an ultrasound diagnosis of PMC were included. Clinicopathologic results, imaging, treatment, and outcome were reviewed.

Results: All cats were male and 21 (80%) were diagnosed with urethral obstruction (UO). Five cats (23.8%) had positive urine culture (*Staphylococcus felis*, 3/5; *Proteus mirabilis*, 2/5) with a median urine pH of 8 (range, 6-9). All cats had ultrasonographic changes suggestive of mineralization. On ultrasound examination, 10 cats (38.5%) had pseudomembranes with acoustic shadowing suggestive of mineralization, 15 (57.7%) had changes indicative of ulceration, and 8 (31%) had changes compatible with of a urachal anomaly. Twenty-two cats received medical treatment, 4 underwent surgery (3 percutaneous cystolithotomy, 1 cystotomy). Twenty cats (77%) survived to discharge. Follow-up ultrasound examination indicated resolution of PMC in 6/7 cats, 4 had persistent hyperechoic bladder lining. Five of 12 cats with follow-up had a relapse of lower urinary tract signs.

Conclusions and Clinical Importance: Pseudomembranous cystitis was diagnosed mainly in male cats with UO and imaging findings suggestive of mineralization were present in all cases. Frequent negative urine culture suggests a different etiology than encrusting cystitis related to urease-positive bacteria. Good outcomes can be achieved with medical management.



Labelle O, Penninck D, Butty E, Hahn S, Dunn M

J Vet Intern Med 2023

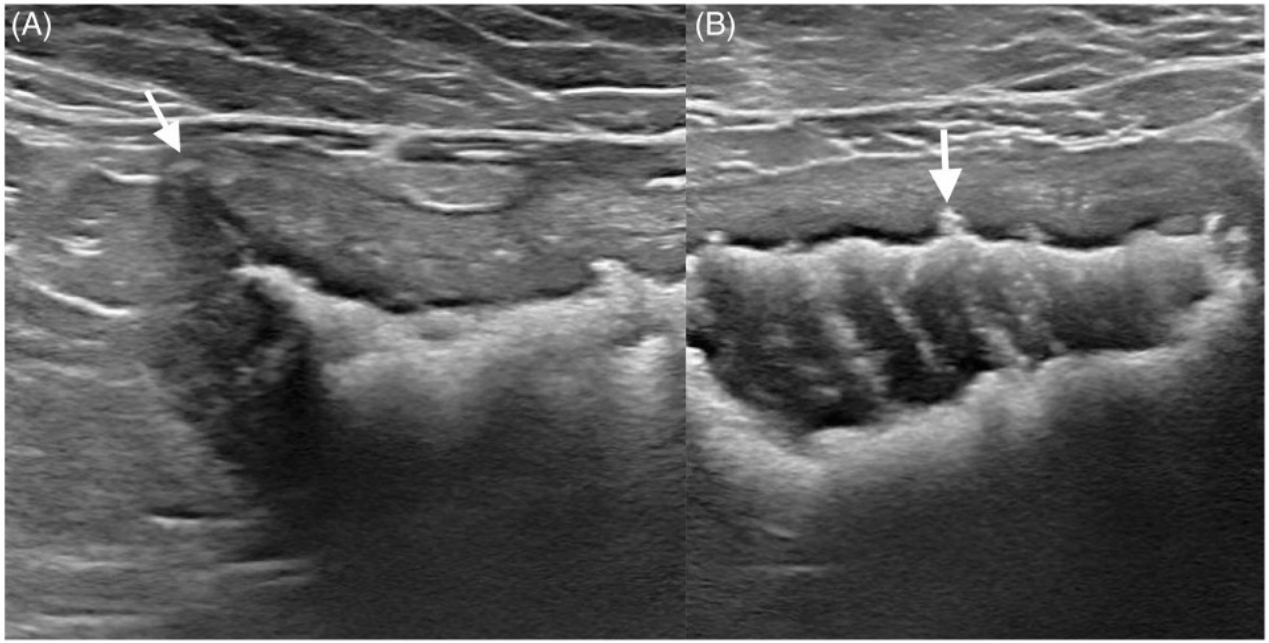


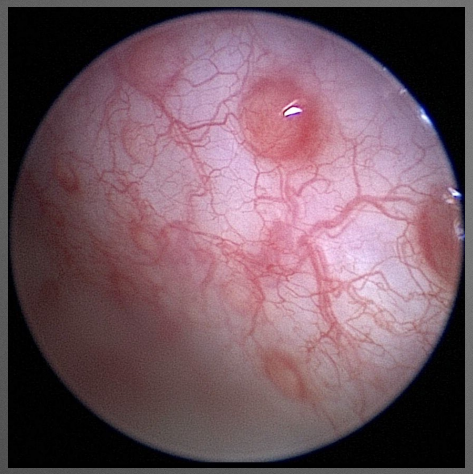
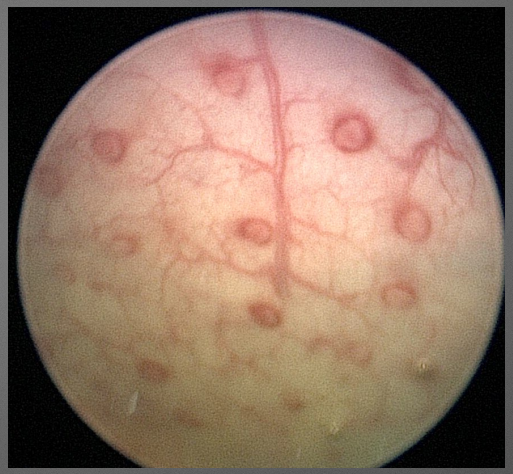
FIGURE 1 Longitudinal sonogram of the bladder of an 8-year-old castrated male domestic medium hair cat with PMC and mineralization. (A) The apex of the bladder was pointed (arrow). The bladder wall reached up to 6.5 mm in thickness. Mineralized (confirmed radiographically) lining associated with shadowing was noted along the ventral bladder wall. (B) Transverse sonogram after filling the bladder with saline. Numerous hyperechoic strands are seen crossing the lumen. Mucosal ulceration (arrow) is noted at several locations along the ventral wall.

Labelle O, Penninck D, Butty E, Hahn S, Dunn M
J Vet Intern Med 2023

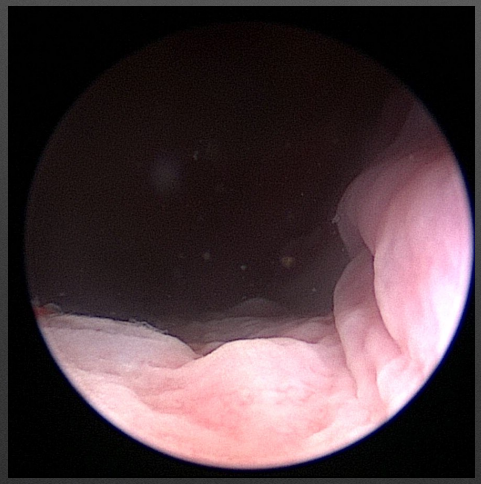
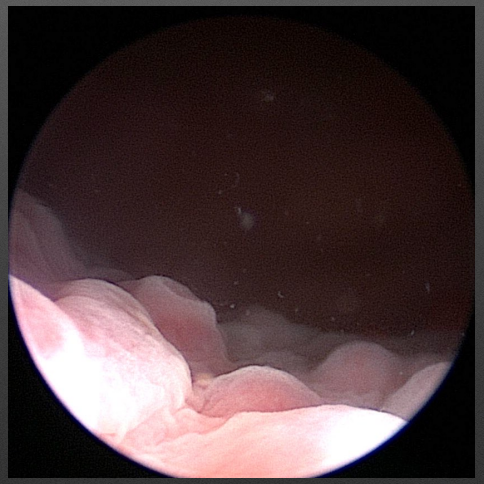
Follicular Cystitis

Best seen with linear probe!

7-month-old Golden Retriever-cross presented for chronic UTI and urinary incontinence. Suspicion of ectopic ureters?

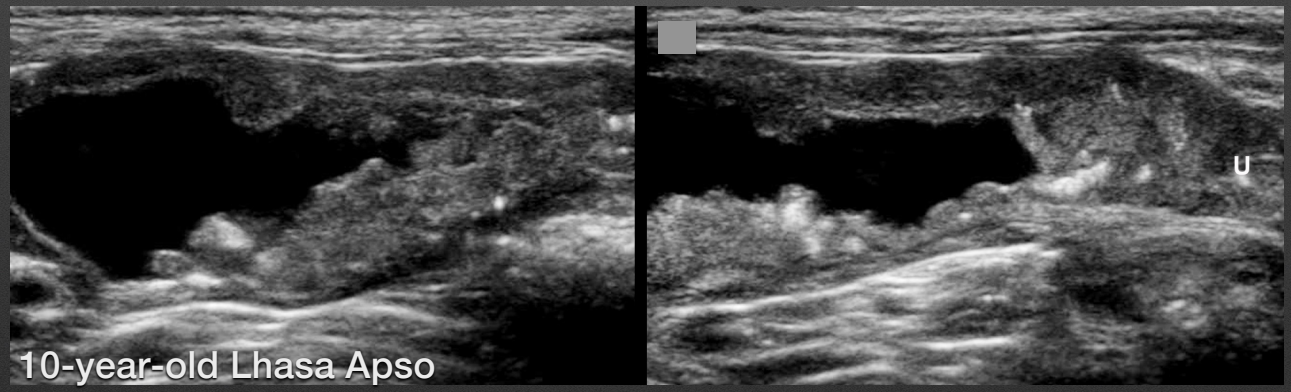
Glomerulation= petechial hemorrhage

Mild to moderate, multifocal, chronic lymphoplasmacytic follicular cystitis

Bladder tumors

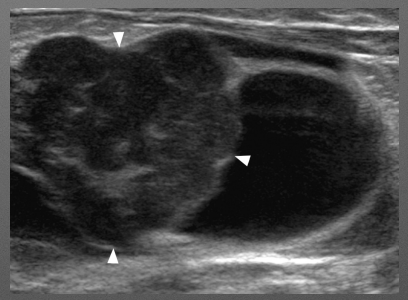
- Transitional Cell/urethelial Carcinoma
  - Broad-based often moderately echoigenic mass or wall thickening
  - Often localized in trigone/neck region, but can occur elsewhere
  - May obstruct ureters and/or urethra
  - DDx: Polypoid cystitis, blood clot or other neoplasia.

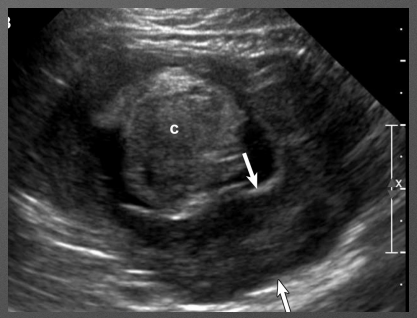


Bladder TCC

Other bladder tumors

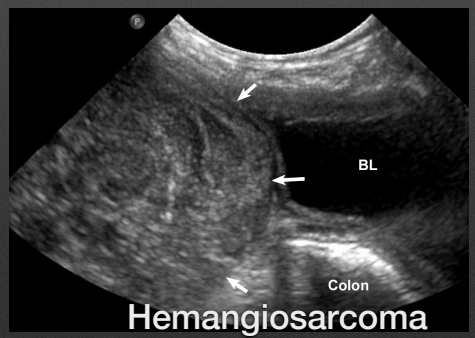
- **Epithelial tumors**
  - Squamous cell carcinoma (SCC)
  - Other carcinomas
- **Other types**
  - Leiomyoma, leiomyosarcoma
  - Rhabdomyosarcoma
  - Fibroma, fibrosarcoma
  - Lymphoma, MCT, hemangiosarcoma





Lymphoma

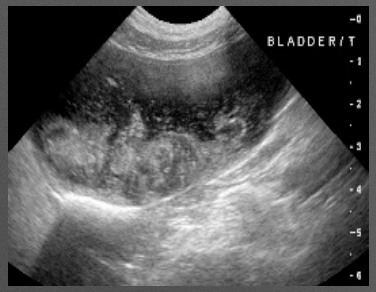
Leiomyosarcoma



Hemangiosarcoma

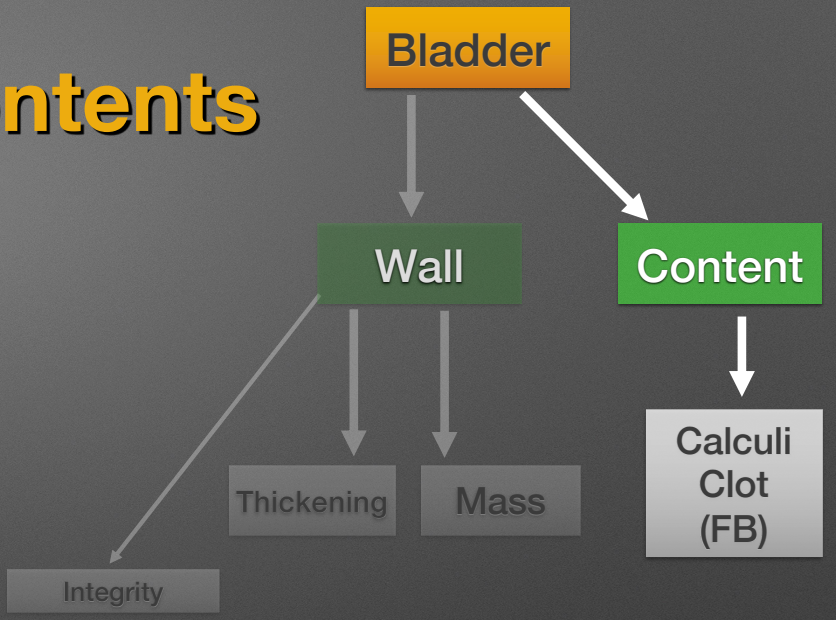
Mast cell tumor

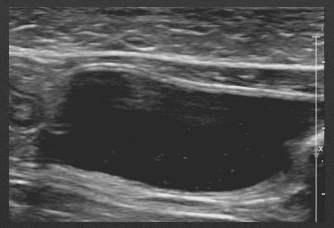
Atlas of Small Animal Ultrasonography

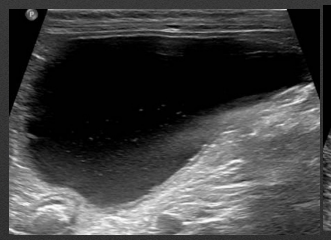


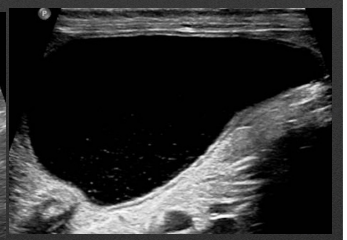
Bladder Contents

- Lipid droplets
- Calculi
- Blood clot
- Pus
- foreign material
- Laminated debris balls

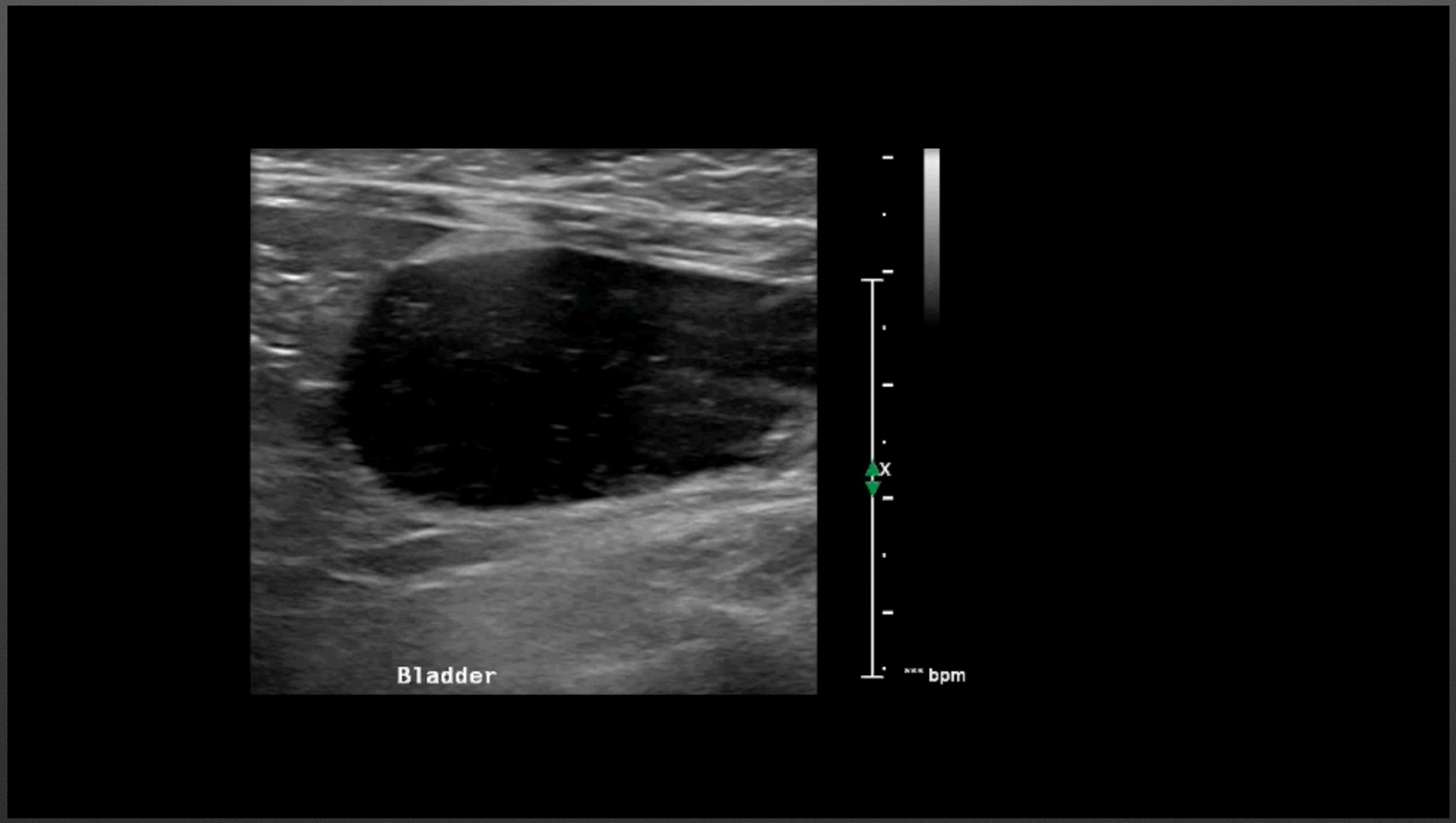




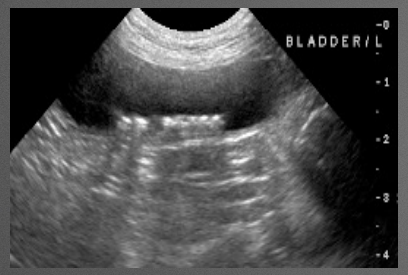


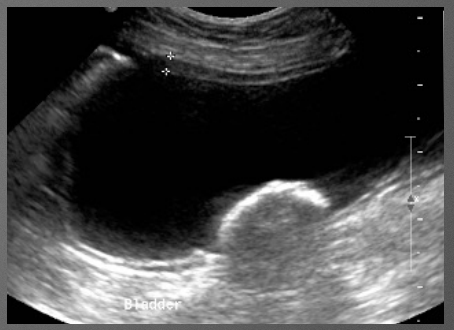


Lipid droplets



Calculi

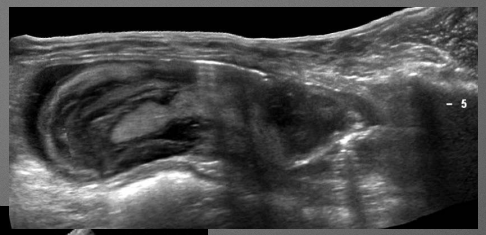


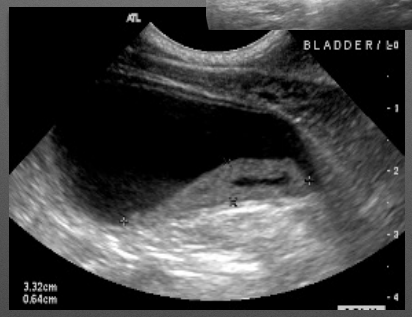


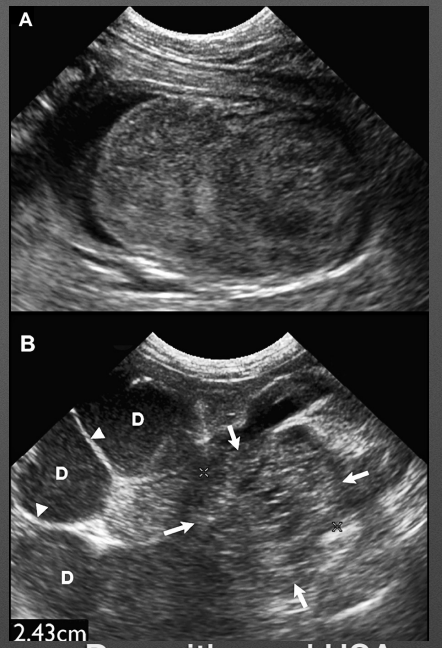
Cystitis and struvite stones cat

Blood clots

- Presence of hematuria
- Amorphous, variable size
- Mixed echogenicity
- Concurrent mass ?

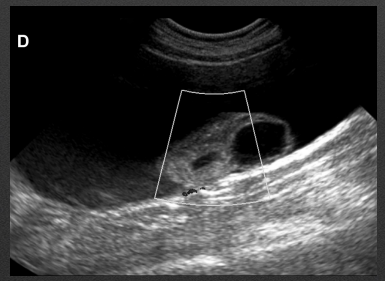


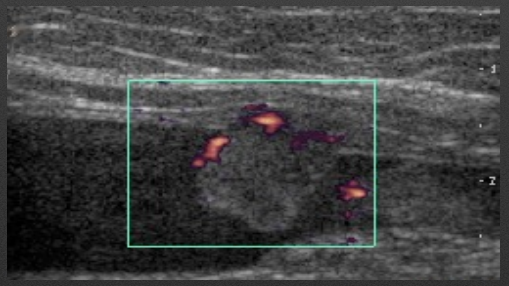


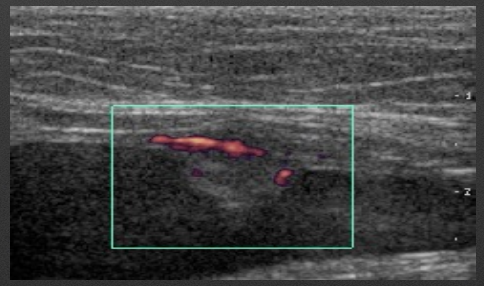


Dog with renal HSA

- How to differentiate from wall nodule/mass?







Interventional Procedures & Monitoring

- Fine-needle aspirate
- Core biopsy
- Pyelocentesis
- Drainage
- SUB flushing and assessment
- Stent assessment
- Pharmaceutical delivery/ablation

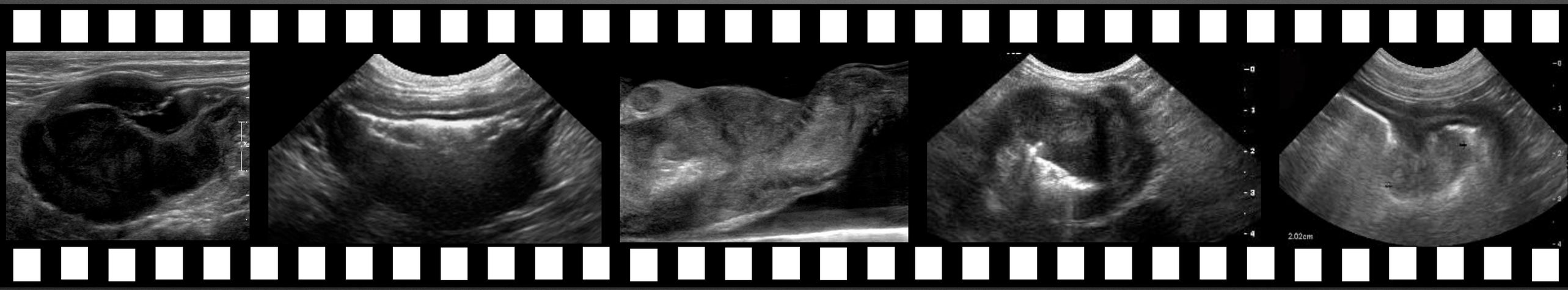
CONCLUSIONS

- ★Consider the signalment and clinical history
- ★Combine ALL the US findings
- ★Evaluate the entire urinary system...and more
- ★Perform FNAs or biopsies to confirm!

Questions?

GI Nodules and Masses

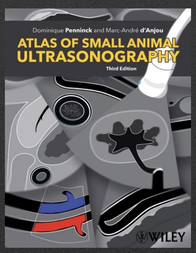
Part 1



Dominique Penninck, DVM, PhD, DACVR, DECVDI

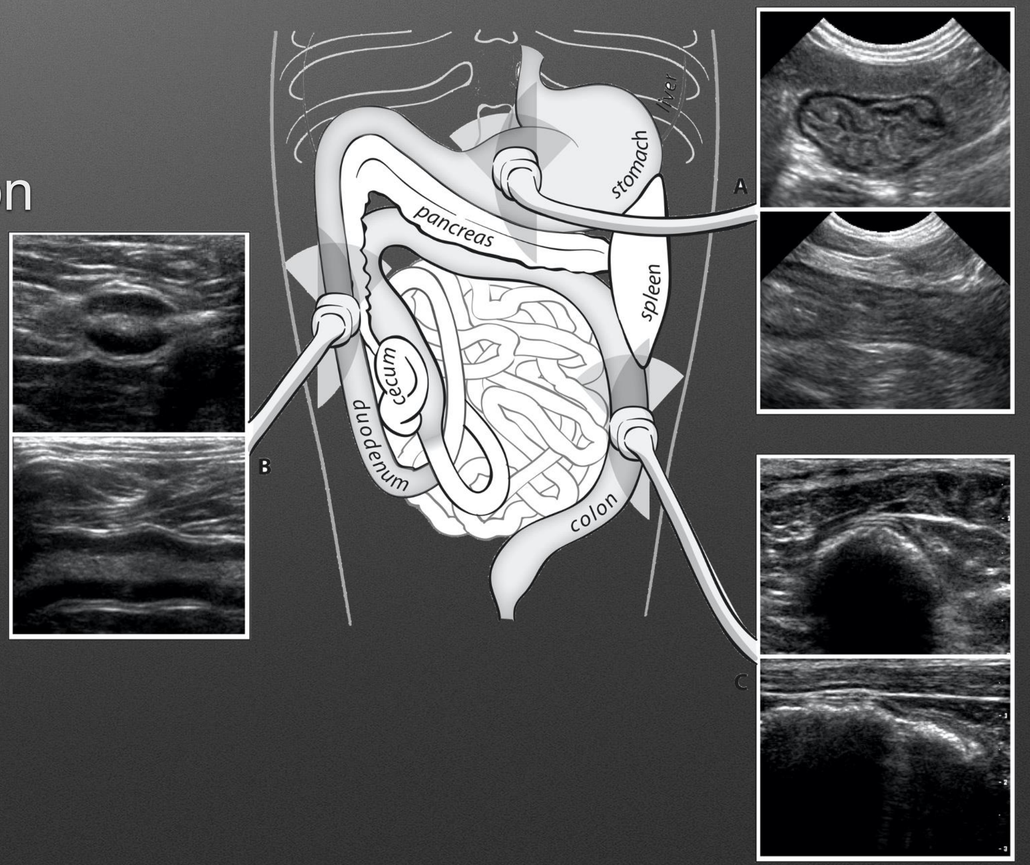
Professor, Diagnostic Imaging, Tufts University

SmallAnimalUltrasonography.com & Atlas of Small animal ultrasonography

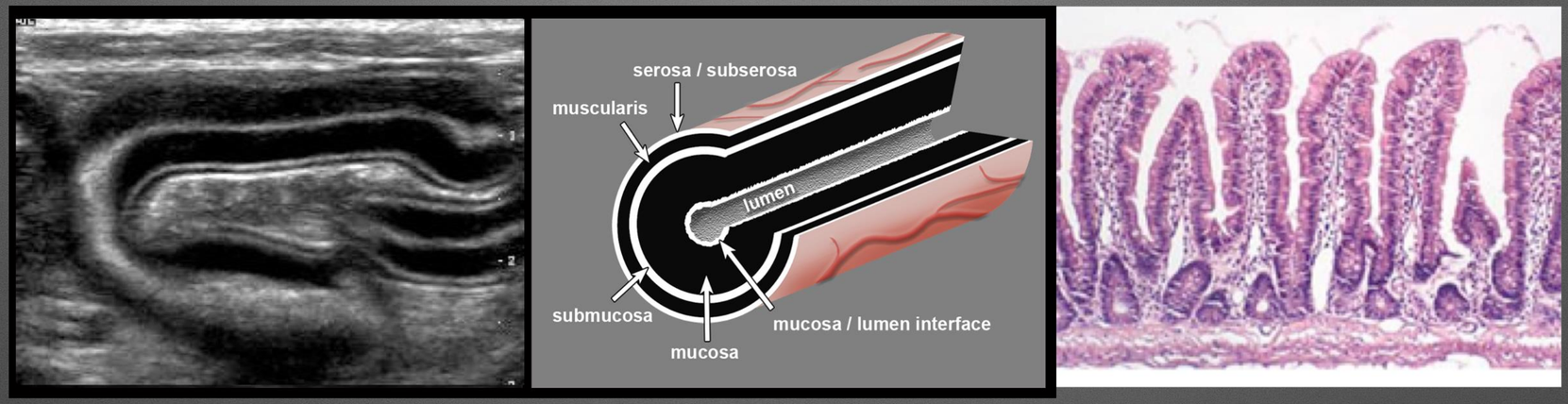


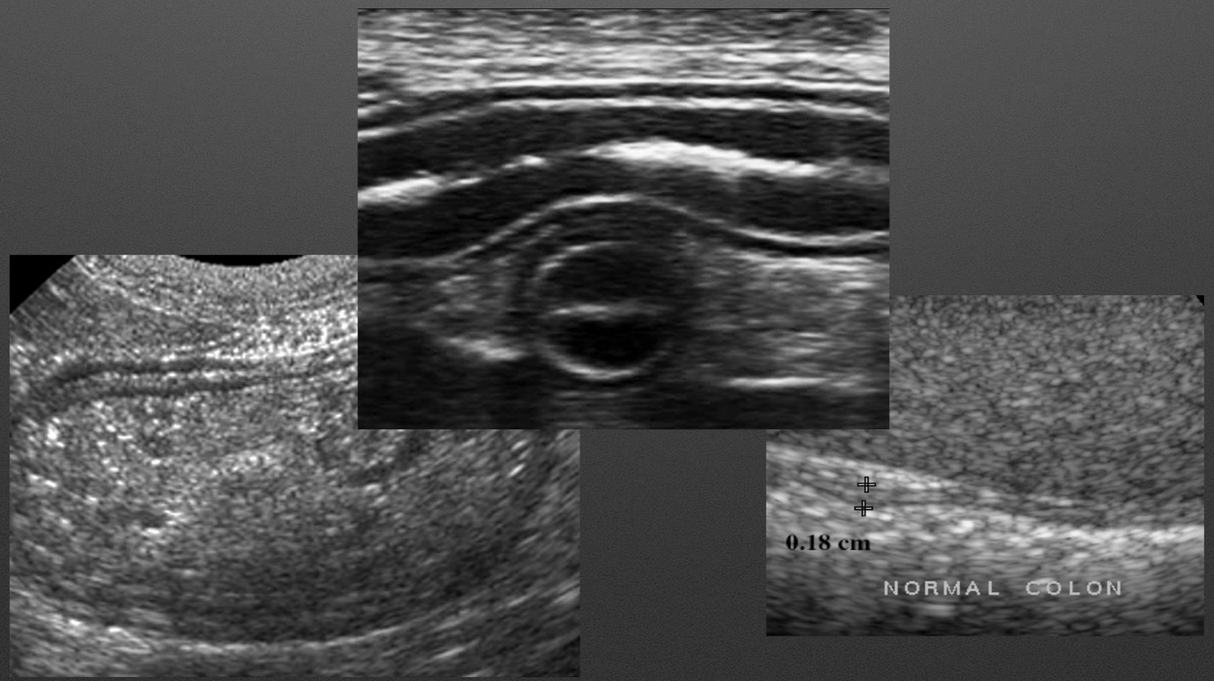
Morphologic Approach

- Location: fundus/body/antrum/pyloro-duodenal junction/intestines/ICJ/colon
- Distribution: focal, segmental, multi-segmental
- Thickness, echogenicity and layering distribution
- Obstructive or not
- Lymph node? Other organs?



Thickness & Layering

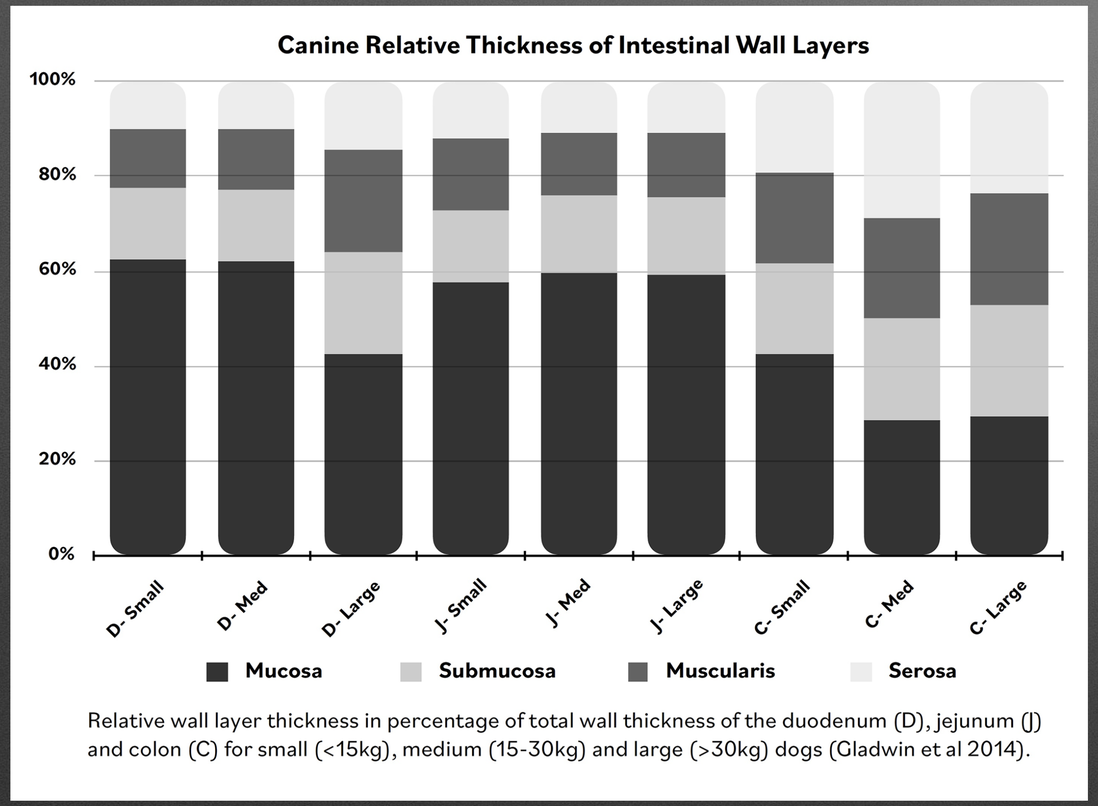




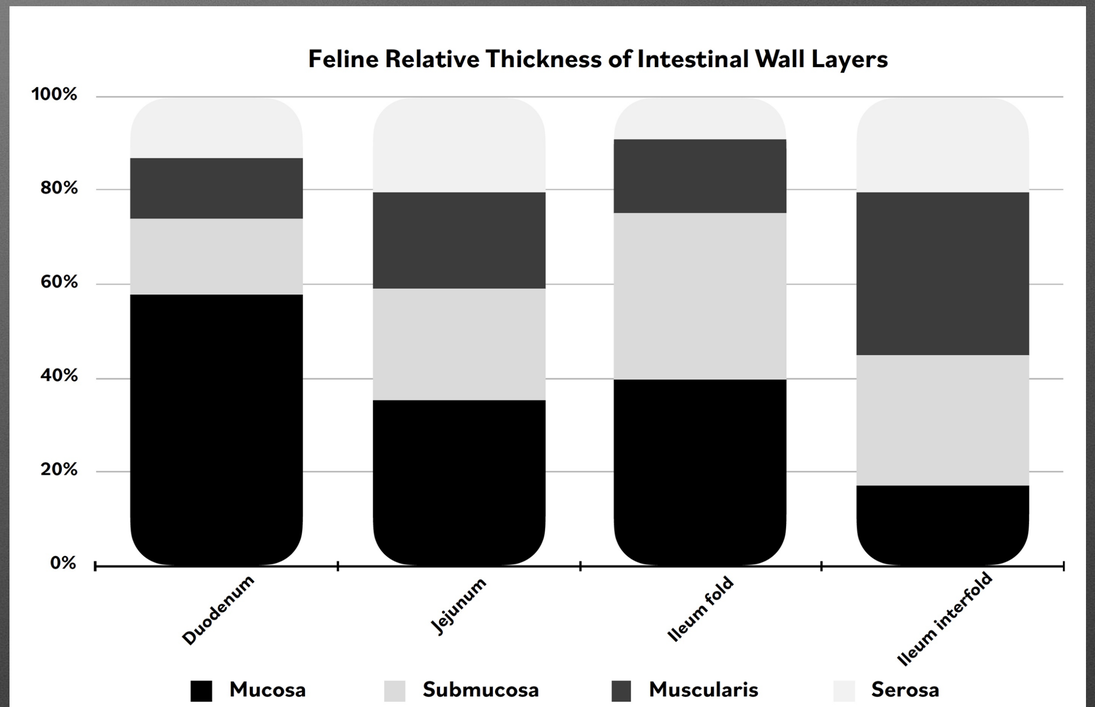
Mean measurements

DOG	Stomach	Duod	Jejunum	Ileum	Cecum	Colon
<15 kg	2-5 mm	3.8	3.0	3.0	as colon	Up to 1.5
15-30kg	2-5 mm	4.1	3.5	3.5	as colon	Up to 1.5
>30 kg	2-5 mm	4.4	3.8	3.8	as colon	Up to 1.5
CAT	2-4 mm	2.2	2.2	2.8	2-3	Up to 1.5

Wall layers

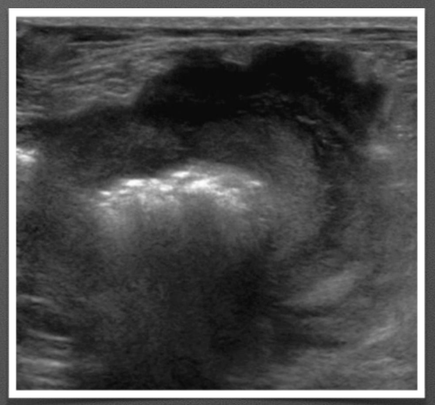


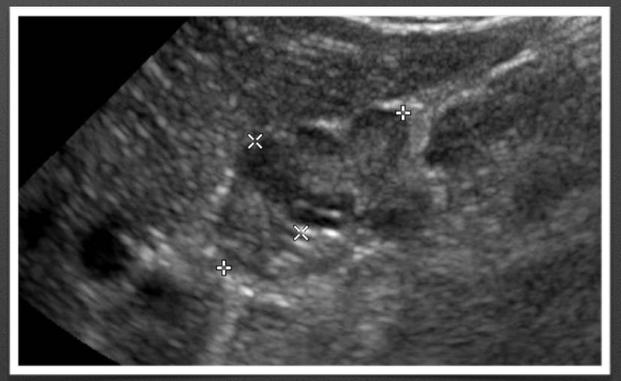
Relative wall layer thickness in percentage of total wall thickness of the duodenum (D), jejunum (J) and colon (C) for small (<15kg), medium (15-30kg) and large (>30kg) dogs (Gladwin et al 2014).



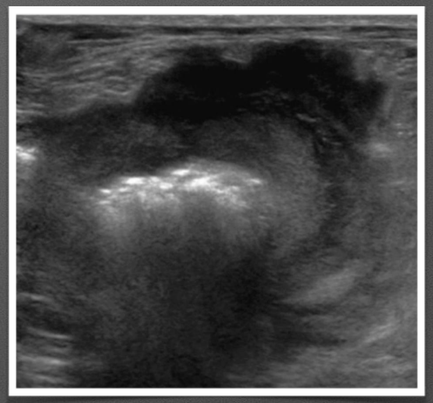
Relative wall layer thickness in percentage of total wall thickness of the duodenum (D), jejunum (J), and ileum measured at the fold and interfold locations for cats (Di Donato et al 2014).

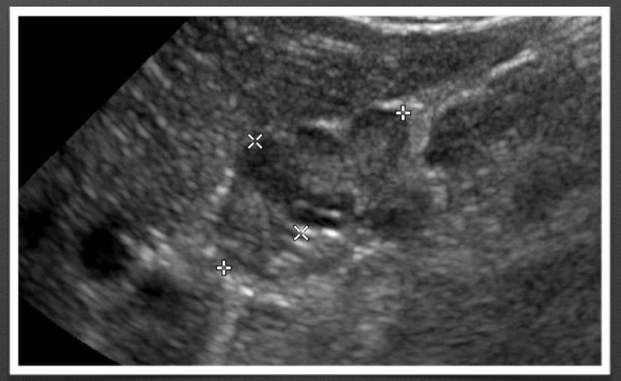
12-year-old cat with hyporexia and vomiting





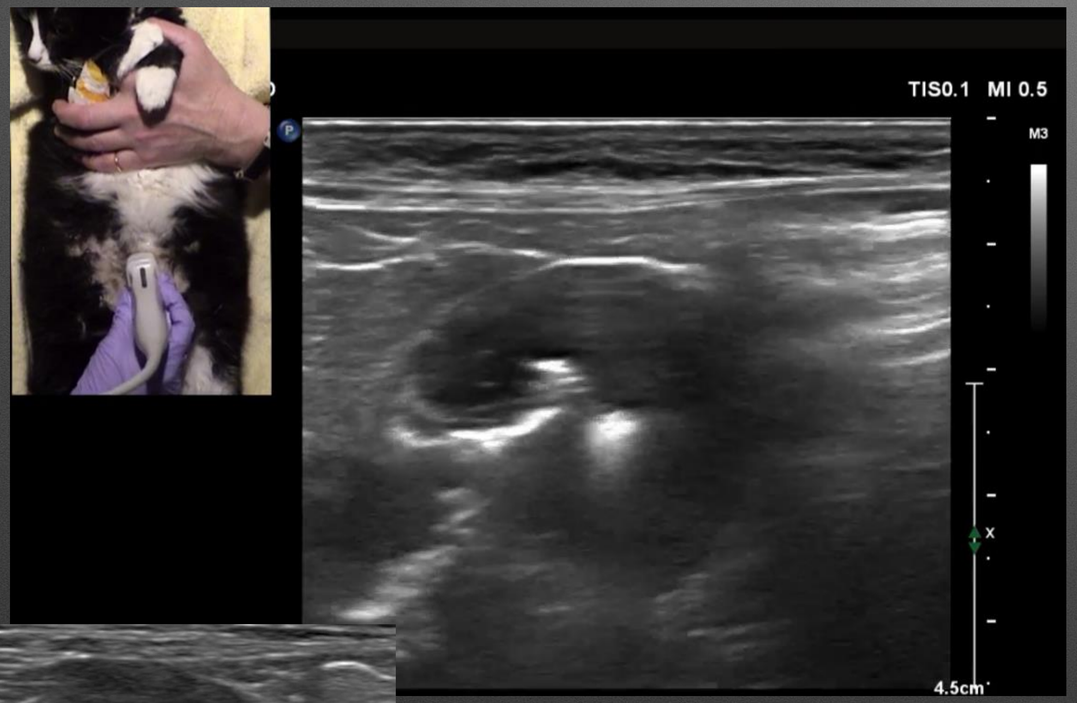
12-year-old cat with hyporexia and vomiting

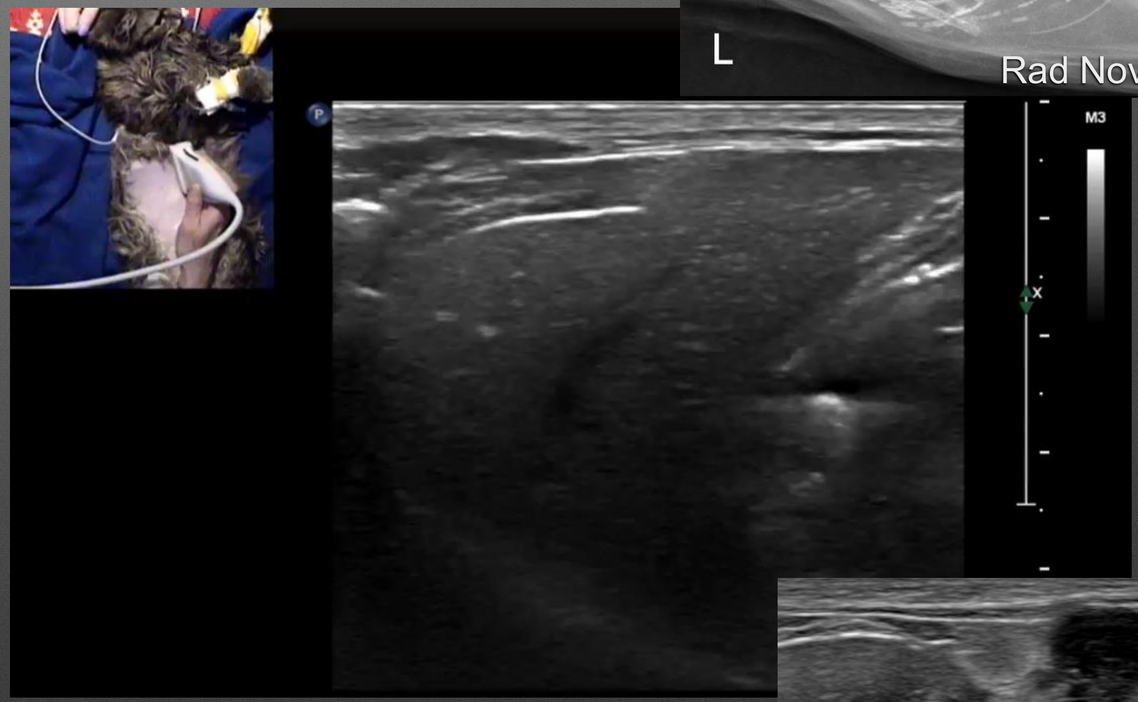




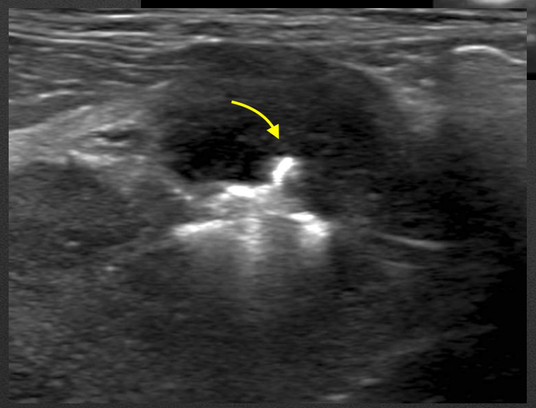
FNAs confirmed gastric lymphoma

Other findings…





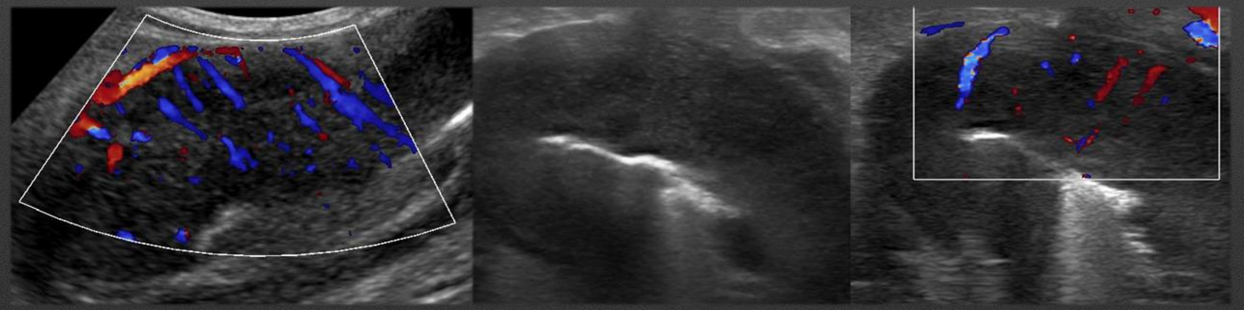
February study



B-mode ultrasound and colour Doppler findings in cats with gastric lymphoma

Quinci M, Pey P, Diana A, De Jesus A, Penninck D

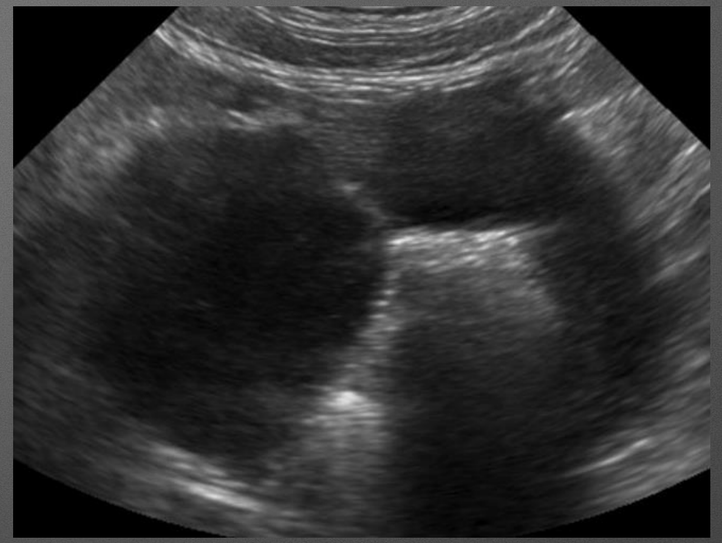
The most common US appearance of gastric lymphoma was **transmural hypoechoic segmental** wall thickening with **layering loss**. Location and distribution were variable. Colour Doppler displayed increased blood supply with a predominant pattern of perpendicular vessels, possibly representing aberrant arteries originating from subserosal and submucosal plexus. Lymphomatous infiltration of lymph nodes and other abdominal organs was frequent, confirming local and distant aggressiveness of gastric lymphoma in cats. Vomiting and haematemesis were frequently associated with the suspicion of ulcer on US. Perforation was a rare occurrence.

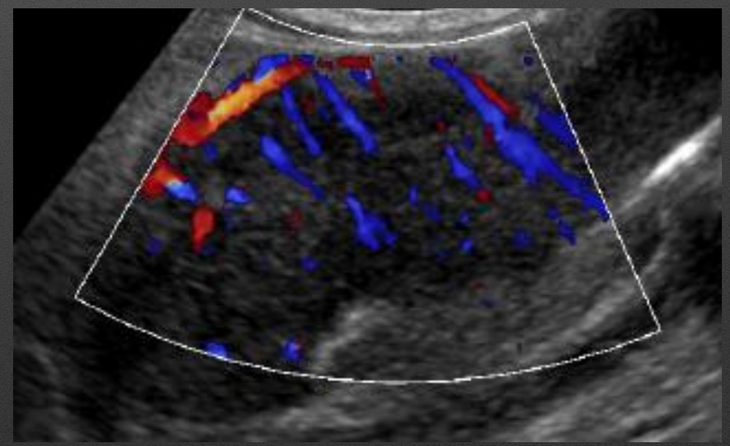


JFMS-2023

Main findings (45 cats)

- ✓ 71% transmural thickening
- ✓ 93% absent layering
- ✓ 85 % hypoechoic
- ✓ 2.1 cm mean maximum thickness
- ✓ 51% ulcers
- ✓ 97.7% lymphadenopathy
- ✓ 53% suspicion multicentric
- ✓ 24 % effusion

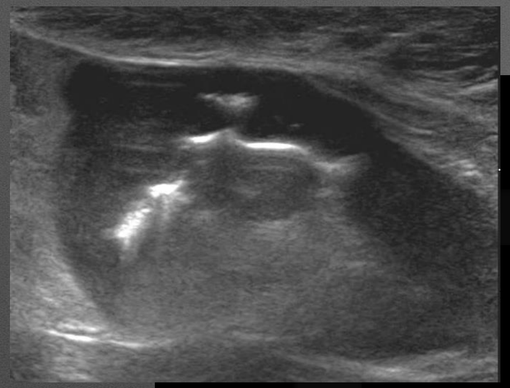


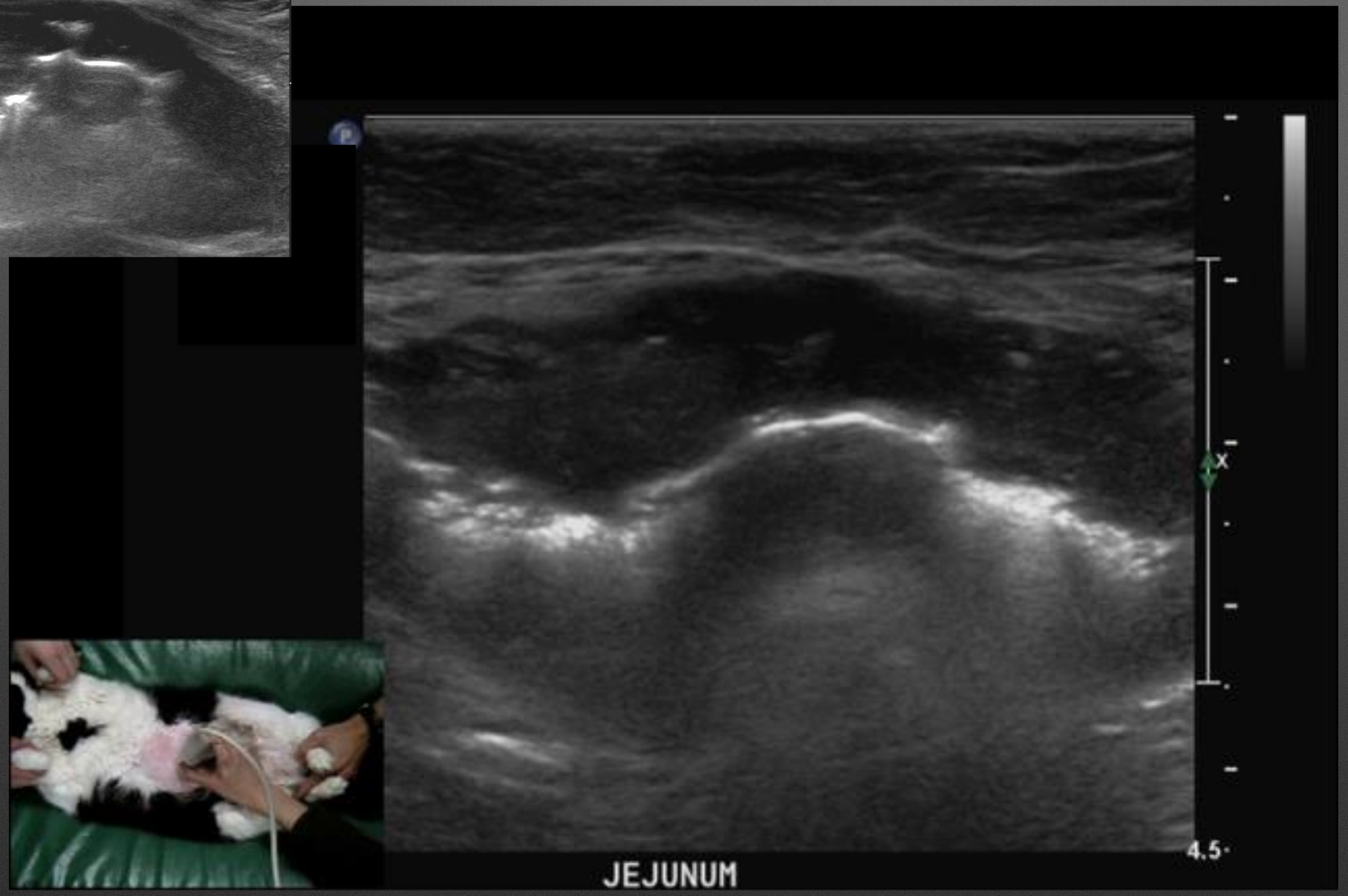


JFMS-2023

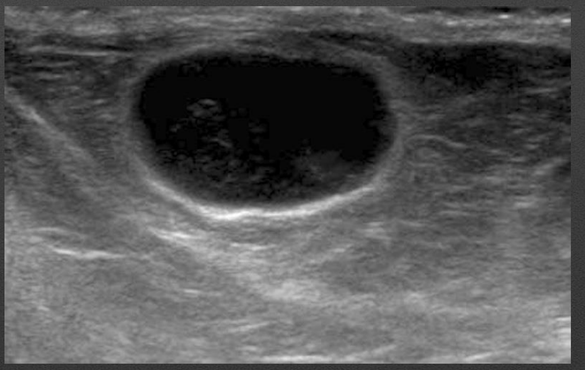
13-year-old cat presented for anorexia and weight loss. An abdominal mass was palpated.

Jejunal Location





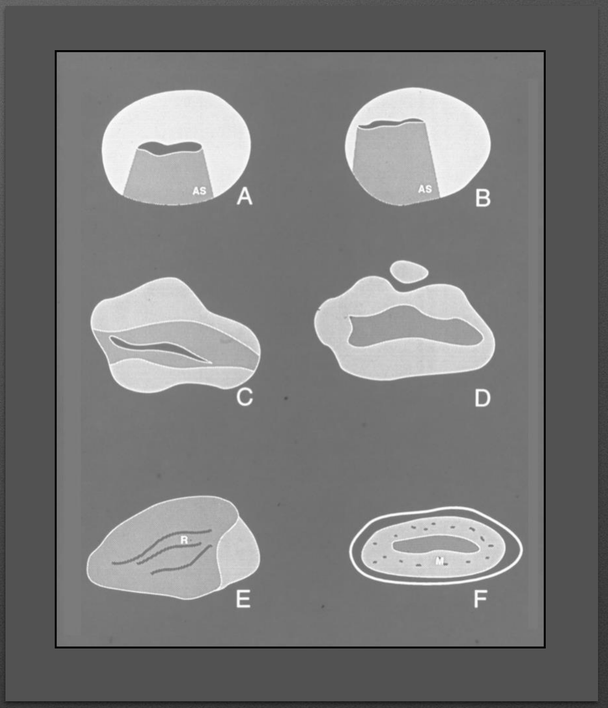
Jejunal LN



Inguinal LN

US Features of Lymphoma

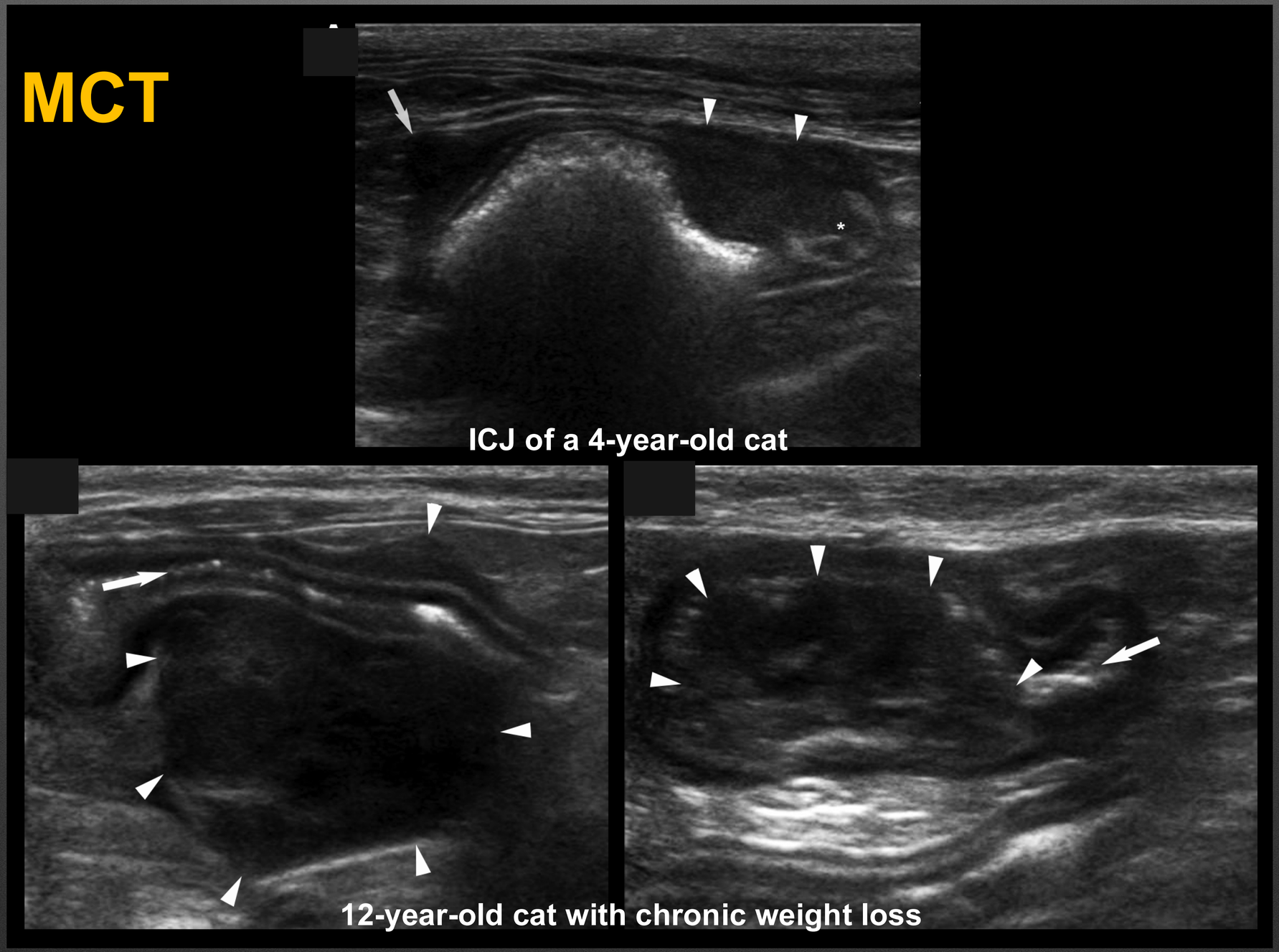
- segmental thickening/mass
- Loss of layering, poorly echogenic
- Often circumferential
- Often regional lymphadenopathy
- Rarely obstructive



Vladimir is a 12-year-old cat presented with decreased appetite and weight loss

Mast cell tumor

Feline MCT



ICJ of a 4-year-old cat

12-year-old cat with chronic weight loss

Mast Cell Tumor

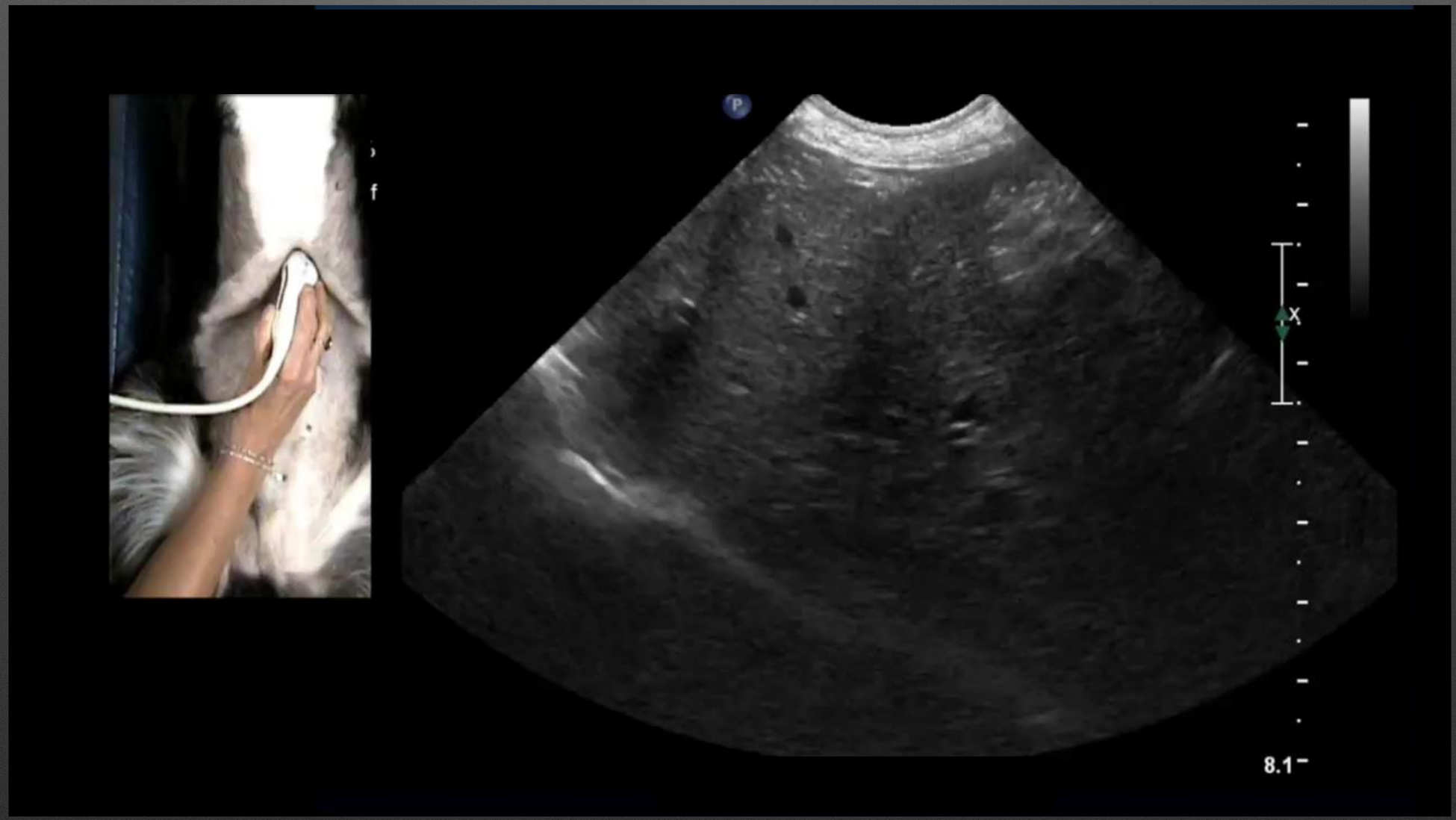
ULTRASONOGRAPHY OF INTESTINAL MAST CELL TUMORS IN THE CAT

MICHELE P. LAURENSON, KATHERINE A. SKORUPSKI, PETER F. MOORE, ALLISON L. ZWINGENBERGER

The sonographic features of intestinal mast cell tumors (MCT) were reviewed in **14 cats**. The mean age was 13.4 - 2.5 years. There were 16 focal intestinal tumors and one diffuse submucosal infiltrate. The most common pattern was **focal, hypoechoic wall thickening that was non-circumferential and eccentric (9/16 tumors) or circumferential, asymmetric, and eccentric (5/16 tumors)**. Nine of the cats had lesions in the jejunum or duodenum, four were at the ileocecocolic junction, and one cat had a colonic mass. **Six MCTs had altered but not loss of wall layering**, and the most commonly affected layer on ultrasound examination was the muscularis propria. **Nine cats had enlarged abdominal lymph nodes, and seven were due to metastatic disease.** Metastatic disease was not routinely detected by ultrasound in the liver (1/4 cats) or the spleen (0/3 cats). Concurrent small cell (T cell) lymphoma was present in four of 14 cats (29%).

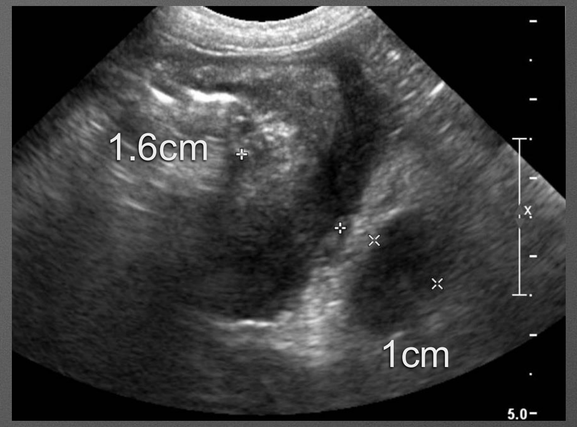
2011 Veterinary Radiology & Ultrasound, Vol. 52, No. 3

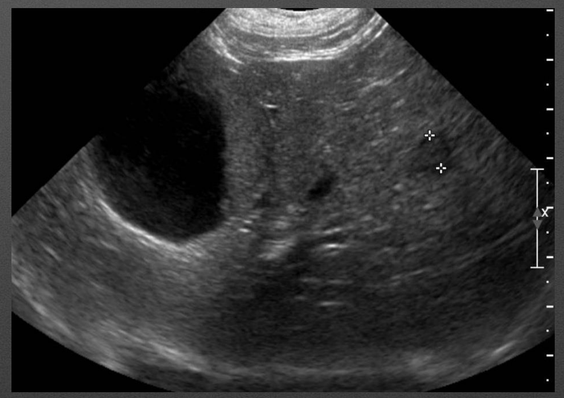
10-year-old Border Collie/cross presented for 8 weeks of vomiting, anorexia and weight loss



US findings

- Marked segmental wall thickening with altered layering
- Regional lymphadenomegaly
- Hepatic nodules





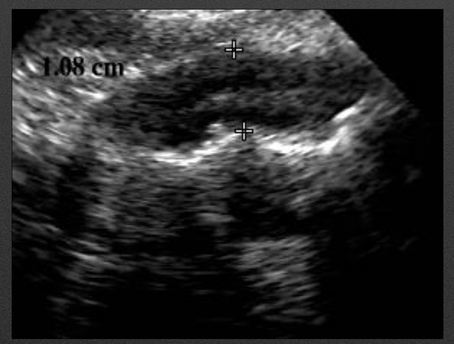
Cytology: blood contamination, possible mesenchymal neoplasm

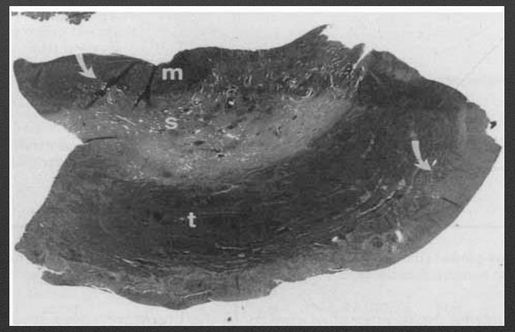
Necropsy: confirmed **gastric carcinoma**

with metastases to regional lymph nodes and liver

Ultrasonography of Canine Gastric Epithelial Neoplasia

Signalment, clinical and ultrasonographic findings from 16 dogs with histologically confirmed gastric epithelial neoplasia were reviewed. The most common clinical findings were vomiting, anorexia and weight loss. Hematemesis and melena were uncommon findings. Ten (10/16) dogs were female and there were four Chows. The most common ultrasonographic findings were transmural thickening of the gastric wall associated with altered wall layering. A poorly echogenic lining often was noted on the innermost and/or the outermost portions of the gastric wall, separated by a more echogenic central zone. The distribution of these changes was variable. This ultrasonographic feature, called pseudolayering, was present in 14 dogs. It was believed to most likely correlate to the unevenly layered tumor distribution noted histopathologically. The maximum wall thickening ranged from 1 cm to 2.7 cm. Regional lymphadenopathy was identified ultrasonographically in 15 dogs. Ultrasound-guided fine-needle aspiration biopsy or automated microcore biopsy, endoscopic biopsy, surgical biopsy or necropsy resulted in the diagnosis of carcinoma in 15 dogs and of carcinoid tumor in one dog. The results of this study suggested that ultrasonography was a useful tool for the detection and diagnosis of canine gastric epithelial neoplasia. Furthermore, ultrasonography can assist in obtaining diagnostic samples and in clinical staging of the tumor. *Veterinary Radiology & Ultrasound, Vol. 39, No. 4, 1998, pp 342–348.*



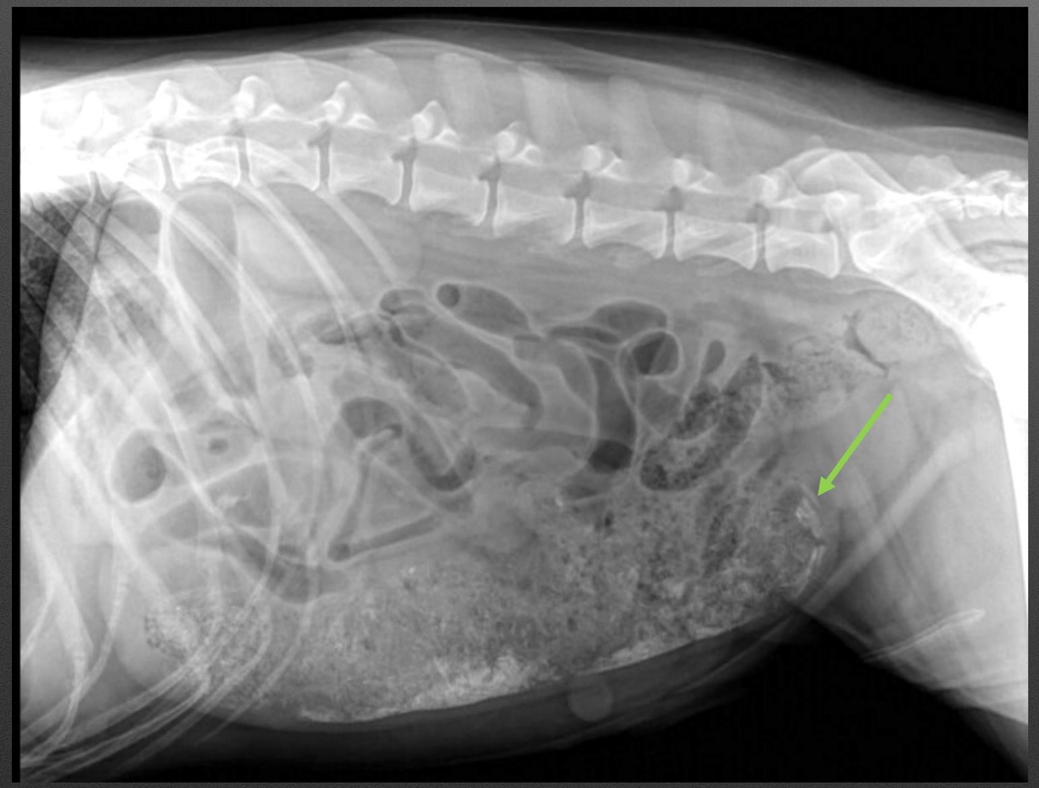


Penninck et al. Vet Radiol & US, 1998

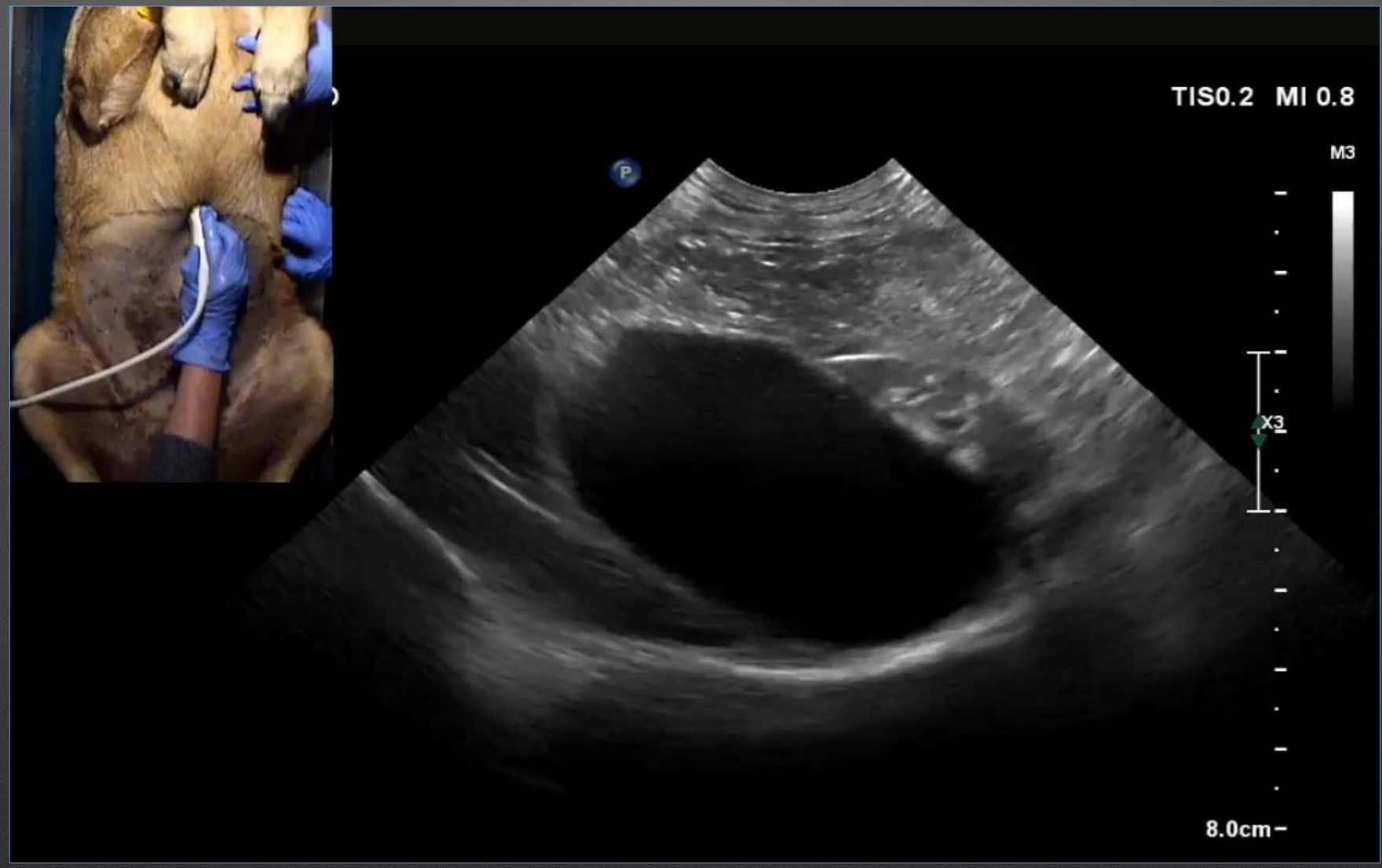
Carcinoma and Gastric Edema

Marked wall thickening (>1cm)
“spongy” appearance (edema)

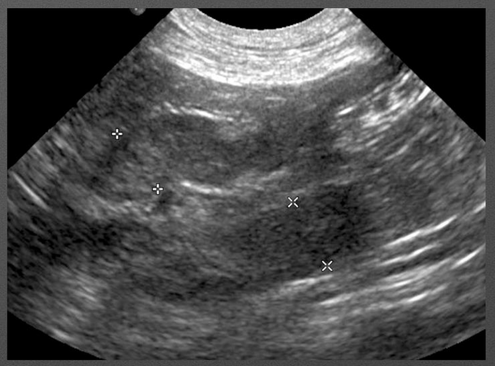
10-year-old Shepard-x with 1 month of weight loss, decreased appetite and vomiting/intermittent diarrhea. Physical exam and bloodwork are unremarkable.



Referral rads


TIS0.2 MI 0.8
M3
P
X3
8.0cm

Outcome

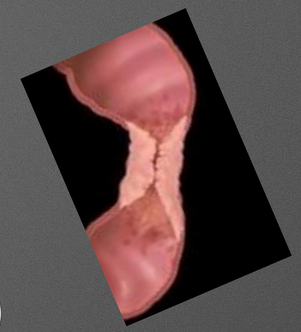


Foreign material accumulated at the stricture site (mid-jejunum)

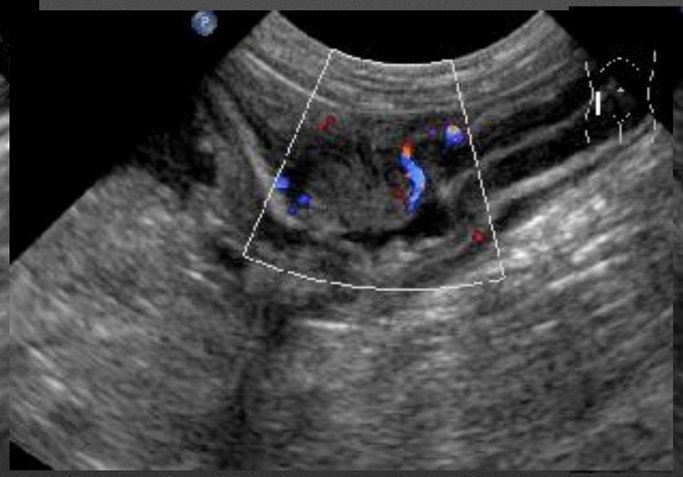
Histopath: adenocarcinoma and marked eosinophilic, lymphoplasmacytic enteritis

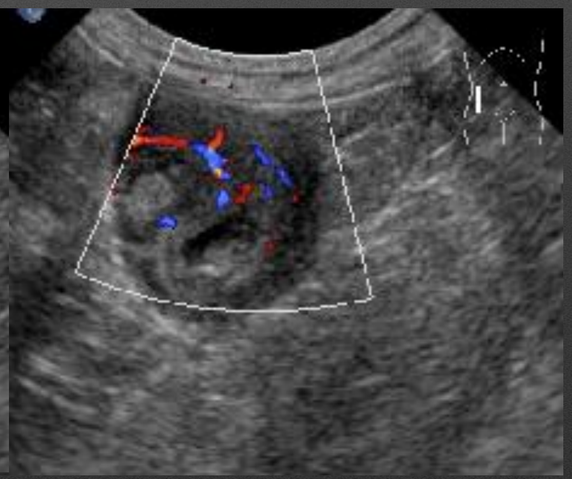
12-year-old cat presented for vomiting, decreased appetite, and weight loss for several weeks

Intestinal Carcinoma



- Focal thickening (short)
- Single
- Loss of layering
- Commonly obstructive



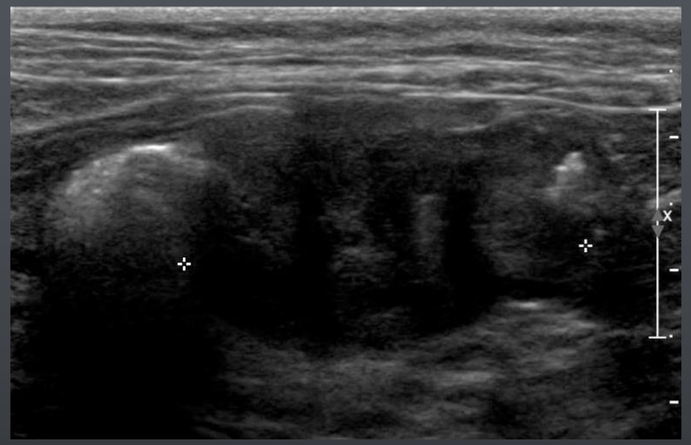


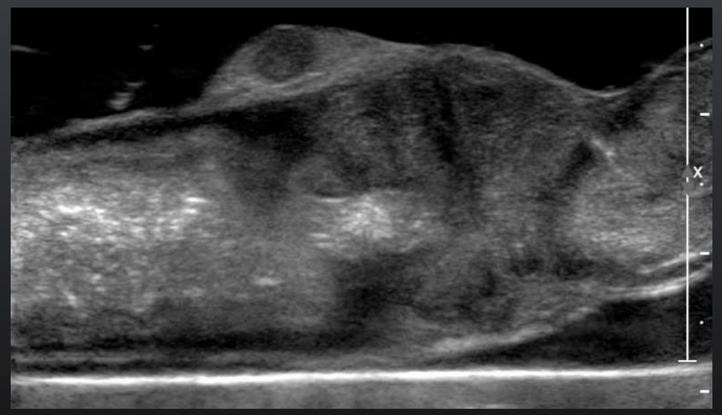
ULTRASONOGRAPHIC AND CLINICOPATHOLOGIC FINDINGS IN 21 DOGS WITH INTESTINAL ADENOCARCINOMA

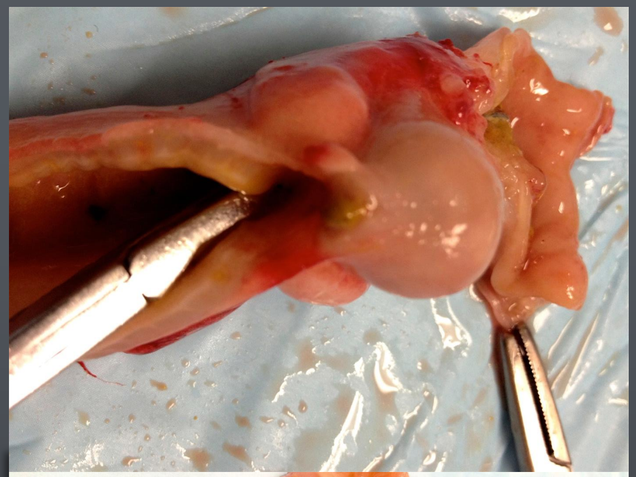
MELISSA C. PAOLONI, DVM, DOMINIQUE G. PENNINCK, DVM, DVSC, ANTONY S. MOORE, BVSC, MVSC

In a retrospective study of 21 dogs with intestinal adenocarcinoma, the signalment, clinical presentation, laboratory findings, ultrasonographic features, treatment, and outcome were reviewed. Anorexia (n = 16), vomiting (n = 15), diarrhea (n = 10), and weight loss (n = 9) were the most common clinical signs reported. Ultrasonographic features that were evaluated included location, length, wall thickness, echogenicity, regional motility, layering, regional lymphadenopathy, and fluid accumulation proximal to the lesion site. All lesions were transmural and associated with complete loss of wall layering. Maximum wall thickening at the lesion site ranged from 7 to 17 mm (median 12 mm, mean 11.9 mm). Most of the dogs had a lesion measuring from 23 to 63 mm in length, (median 40 mm, mean 42 mm). Most intestinal lesions were poorly echogenic and had an irregular lumen. Fluid accumulation proximal to the lesion site was identified in 17 of 21 dogs, and in 13 of 17 dogs the fluid accumulation was considered moderate to severe. Regional lymphadenopathy and/or nodular mesentery/omentum were noted in 12 of 21 dogs. The tumor was located in small intestine for 15 dogs and in the colon for the remaining 6 dogs. Fifteen dogs were treated by surgical resection of the intestinal mass. Their median survival time was 233 days. Only gender appeared to influence survival. Female dogs lived a median of 28 days, whereas male dogs lived a median of 272 days. *Veterinary Radiology & Ultrasound, Vol. 43, No. 6, 2002, pp 562–567.*

In another cat…







ULTRASONOGRAPHIC FEATURES OF INTESTINAL ADENOCARCINOMA IN FIVE CATS

BILL J. RIVERS, DVM, PHD, PATRICIA A. WALTER, DVM, MS, DANIEL A. FEENEY, DVM, MS, GARY R. JOHNSTON, DVM, MS

Adenocarcinoma, followed by lymphosarcoma, are the most common feline intestinal neoplasms. Clinicopathological, survey radiographic, and ultrasonographic findings of five cats with intestinal adenocarcinoma are reported. An abdominal mass was palpable in all five cats, but the mass could be localized to bowel in only two cats. Radiographically an abdominal mass was detected in only one cat. Ultrasonographically there was a segmental intestinal mural mass in all five cats. The mass was characterized by circumferential bowel wall thickening with transmural loss of normal sonographic wall layers. In one cat, the circumferential symmetric hypoechoic bowel wall thickening was similar to that reported for segmental lymphoma. In the other four cats, the sonographic features of the thickened bowel wall were varied, being mixed echogenicity and asymmetric in 3 cats and mixed echogenicity and symmetric in one. The results of the present report suggest that sonographic observation of mixed echogenicity segmental intestinal wall thickening in the cat represents adenocarcinoma rather than lymphosarcoma, although other infiltrative diseases should be considered. *Veterinary Radiology & Ultrasound, Vol. 38, No. 4, 1997, pp 300–306.*

13-year-old West Highland Terrier with 5 days of vomiting and 2 days of anorexia.

Large mass along lesser curvature was a leiomyoma

A 10-year-old CM Portuguese water dog was presented for chronic vomiting (10-month), unresponsive to diet trials.

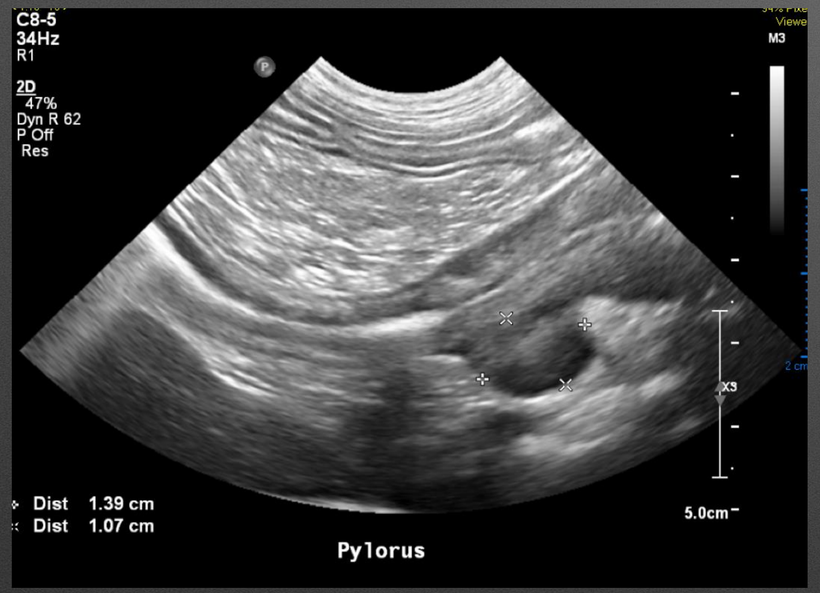
Large mass removed was a leiomyosarcoma

Gastric Angioleiomyoma

Three days ago, an11-year-old Hound mix vomited twice (food and coffee-ground). Now, the dog is anorexic and lethargic. While at the hospital, his PCV dropped to 14%.

While the dog received blood transfusion (250ml), he vomited again coffee-ground material. Melena also developed.

A 13-year-old CM Boston Terrier cross was presented for lethargy (1 month duration). He is worked up for chronic hepatopathy.



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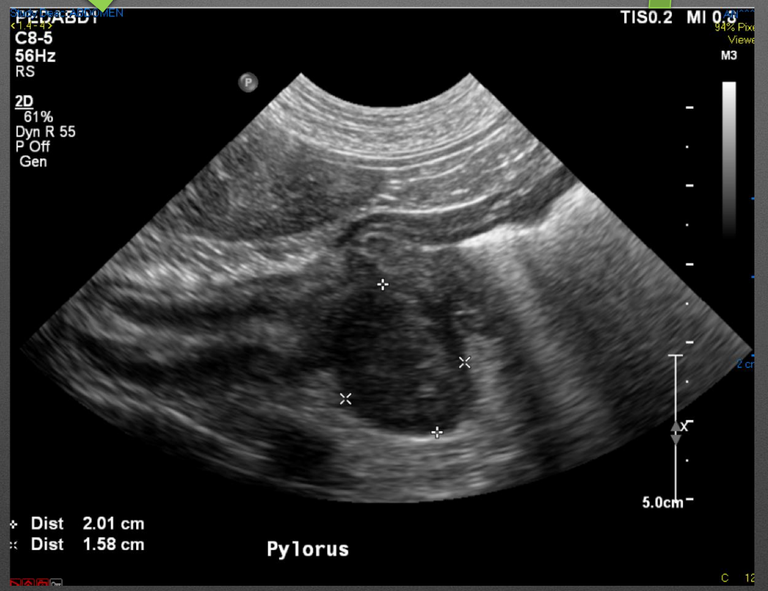

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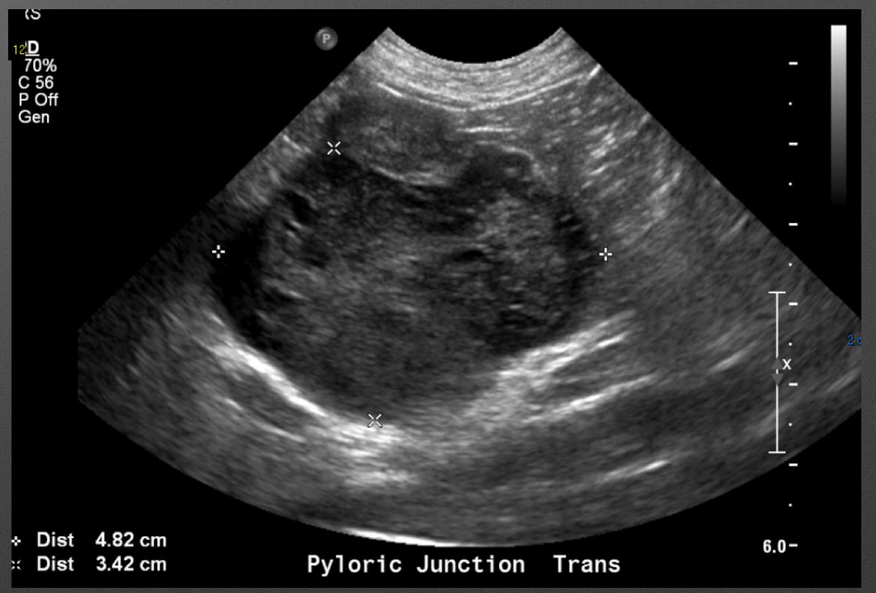


11/13/2020

Outcome

The mass was removed.

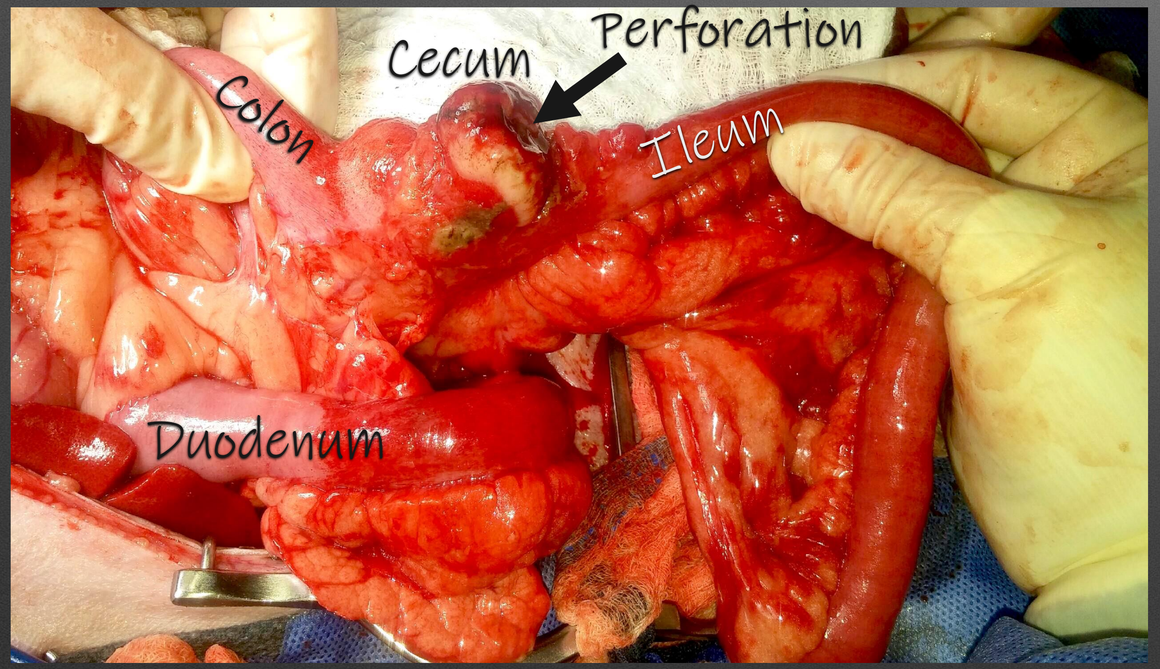
The histopathological diagnosis is mesenchymal tumor (pylorus), favoring Gastrointestinal stromal tumor or Leiomyosarcoma.

The neoplastic cells of the pyloric mass stain strongly positive with CD117 (c-kit) immunostain, consistent with a diagnosis of **gastrointestinal stromal tumor** (GIST).

Duke is a 10-year-old Bichon presented for acute vomiting (last night) and straining to defecate. The dog became suddenly very lethargic. The referral vet worried about pancreatitis. The dog is hypoglycemic (suspected sepsis), hypotensive, and hyperlactemic.

Outcome

A cecal mass was resected along with the ileum and part of the jejunum (abnormal peripheral tissue).



Histo: Stromal tumor confirmed by IHC

ULTRASONOGRAPHIC DIAGNOSIS OF GASTROINTESTINAL SMOOTH MUSCLE TUMORS IN THE DOG

NATHANIEL C. MYERS III, DVM, DOMINIQUE G. PENNINCK, DVM

Historical, physical examination, clinicopathologic, radiographic and ultrasonographic findings of 13 dogs with gastrointestinal (GI) smooth muscle tumors (11 leiomyosarcomas, 2 leiomyomas) were reviewed. History, including signalment and chief complaint, physical examination and bloodwork were neither sensitive nor specific for GI neoplasia. Imaging procedures, radiology and ultrasonography, detected the presence of abdominal masses in 12 patients, including 9 animals lacking a palpable mass on initial examination. Survey radiographs of 10 of the 13 dogs revealed a mass effect in 5/10 dogs, evidence of peritoneal effusion or free abdominal gas in 3/10 dogs, and an obstructive pattern with gas and fluid distension of the intestinal tract in 1/10 dogs. Ultrasonography identified an abdominal mass in 12/13 dogs, and peritoneal effusion in 5 animals. Ultrasonography correctly recognized an association of the mass with bowel segments by the presence of intraluminal gas, within or adjacent to the mass effect, in 10 dogs, and strongly suggested an intestinal origin in one additional animal. GI smooth muscle tumors often appeared as large masses, eccentrically projecting from the bowel wall, frequently containing single or multiple hypo/anechoic regions. Based on this study we conclude that ultrasonography is more sensitive than survey radiography in the detection of GI smooth muscle tumors, and may present specific features to distinguish smooth muscle tumors from other types of GI tumors. Ultrasonography is recommended as a screening procedure for cases where GI neoplasia is suspected.
Veterinary Radiology & Ultrasound, Vol. 35, No. 5, 1994, pp 391–397.

Reclassification of Small Intestinal and Cecal Smooth Muscle Tumors in 72 Dogs: Clinical, Histologic, and Immunohistochemical Evaluation

CERIEL P.H.J. MAAS, DVM, GERT TER HAAR, DVM, Diplomate ECVS, INGRID VAN DER GAAG, DVM, PhD, Diplomate ECVP, and JOLLE KIRPENSTEIJN, DVM, PhD, Diplomate ACVS & ECVS

Objectives—To reclassify canine small intestinal and cecal leiomyoma (LM) and leiomyosarcoma (LMS) into smooth muscle and gastrointestinal stromal tumors (GIST) using histologic and immunohistochemical (IH) analysis and to report clinical findings and survival data.
Study Design—Retrospective review of cases.
Animals—Dogs (n = 47) with small intestinal (40 LMS; 7 LM) and 25 dogs with cecal tumors (23 LMS; 2 LM).
Methods—Clinical and survival data were reviewed. Tissue sections were reevaluated for light-microscopic malignancy criteria and examined for expression of SMA, desmin, vimentin, S-100, and CD117 (KIT) by immunohistochemistry.
Results—Reclassification resulted in 2 LM, 9 LMS, 19 GIST, and 17 GIST-like tumors in the small intestine and 23 GIST and 2 GIST-like tumors in the cecum. GIST-like tumors were morphologic and IH identical to GIST but lacked KIT expression. No significant difference in survival was observed for tumor type, location, histologic, or IH characteristics; however, dogs with cecal tumors were significantly older in age, presented more commonly with intestinal perforation and peritonitis, and less commonly with weight loss. Cecal tumors had more histologic malignancy criteria than small intestinal tumors. After excision, 1 and 2 year recurrence-free periods were 80.1% and 67.2% for small intestinal and 83.3% and 61.9% for cecal tumors.
Conclusion—Prognosis for intestinal tumors with histologic smooth muscle appearance is good after excision and not related to tumor type, location, histologic, or IH characteristics.
Clinical Relevance—Clinical importance could not be demonstrated for reclassification, but may be for future treatment, of intestinal smooth muscle or stromal tumors.
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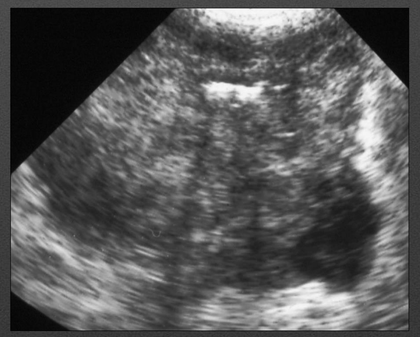
ULTRASONOGRAPHIC FEATURES OF CANINE GASTROINTESTINAL STROMAL TUMORS COMPARED TO OTHER GASTROINTESTINAL SPINDLE CELL TUMORS

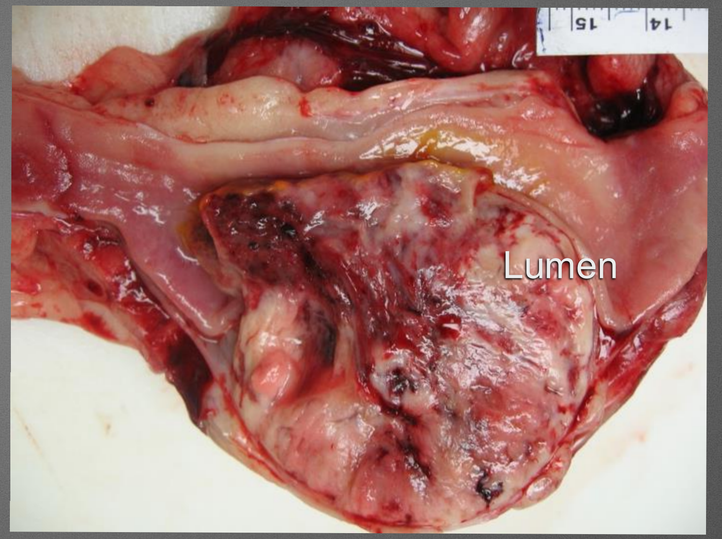
JOSHUA HOBBS, JAMES SUTHERLAND-SMITH, DOMINIQUE PENNINCK, SAMUEL JENNINGS, LISA BARBER, BRUCE BARTON

Canine gastrointestinal stromal tumors (GISTs) are a recent subtype of gastrointestinal spindle cell tumor recognized with the increasing use of immunohistochemistry. To our knowledge, no imaging features have been described in immunistochemically confirmed canine GISTs. The objective of this retrospective, cross-sectional study was to describe ultrasonographic features of canine GISTs compared with other spindle cell tumors. Thirty-seven dogs with an ultrasonographically visible gastrointestinal mass and a histopathologic diagnosis of spindle cell neoplasia were examined. Immunohistochemistry staining was performed for retrieved tissue samples to further differentiate the tumor type and each sample was interpreted by a single veterinary pathologist. Ultrasonographic features recorded examined included mass echogenicity, homogeneity, presence of cavitation, layer of origin, bowel wall symmetry, and loss of wall layering, location, size, vascularity, and evidence of perforation or ulceration. Tumor types included 19 GISTs, eight leiomyosarcomas, six leiomyomas, and four nonspecified sarcomas. Gastrointestinal stromal tumors were significantly more likely to be associated ($P < 0.03$) with abdominal effusion than other tumor types. There was overlap between the anatomical locations of all tumors types with the exception of the cecum where all eight tumors identified were GISTs. Besides location, there were no unique ultrasound features of GISTs that would allow distinction from other gastrointestinal spindle cell tumors. Similar to previous studies, GISTs appeared to be the most common spindle cell tumor associated with the cecum in our sample of dogs. The high frequency of abdominal effusion with GIST's was of unknown etiology could possibly have been due to septic peritonitis. © 2015 *American College of Veterinary Radiology.*

Common Features of Spindle cell tumors SMT and GIST

- Eccentric/exophytic mass
- Often large at time of diagnosis
- Cavitation component (> 3cm)
- Uncommon lymphadenopathy
- Uncommonly obstructive
- Can be associated with intussusception

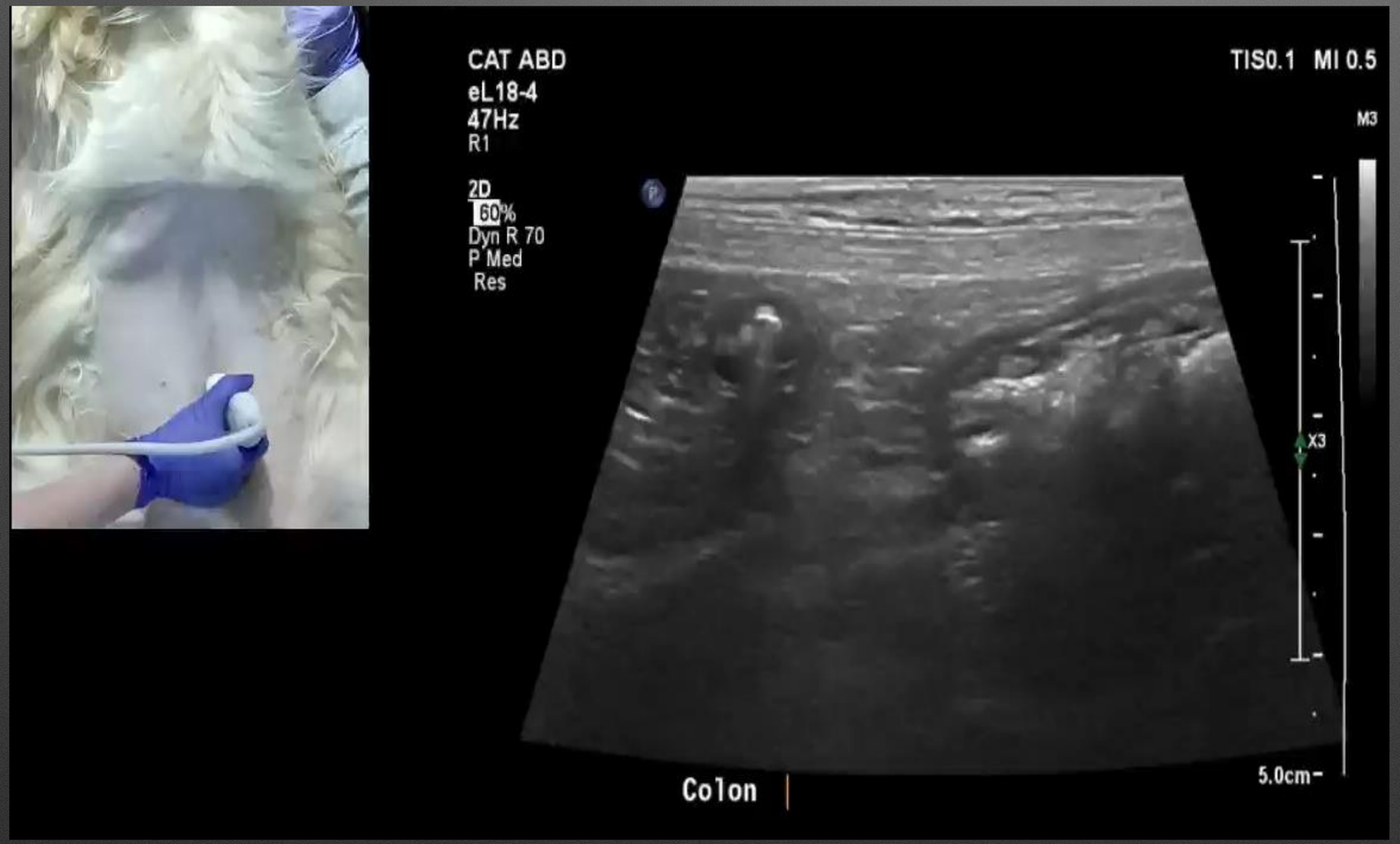




The histological features of the jejunal mass are most consistent with an intermediate grade (low mitotic rate but extensive necrosis and hemorrhage) gastrointestinal stromal tumor (GIST). Immunohistochemistry for smooth muscle actin and c-kit would be needed to confirm.

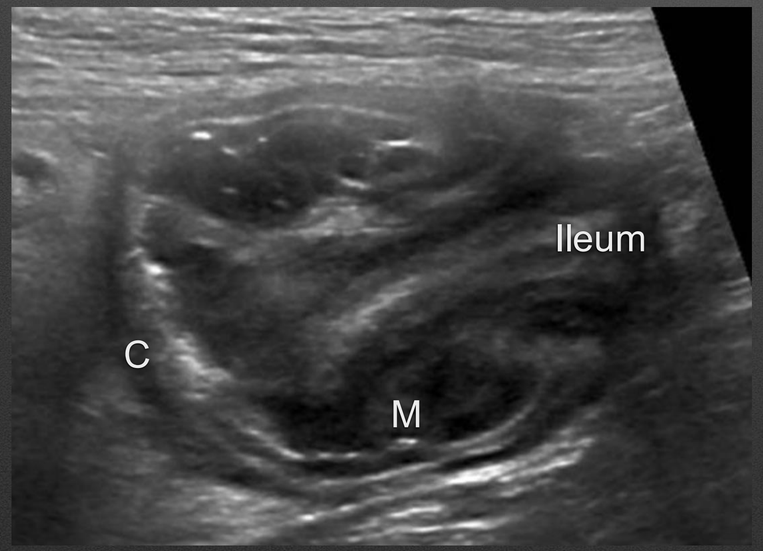
The histological features of the jejunal mass are consistent with GIST and there was concurrent marked chronic eosinophilic and lymphoplasmacytic enteritis

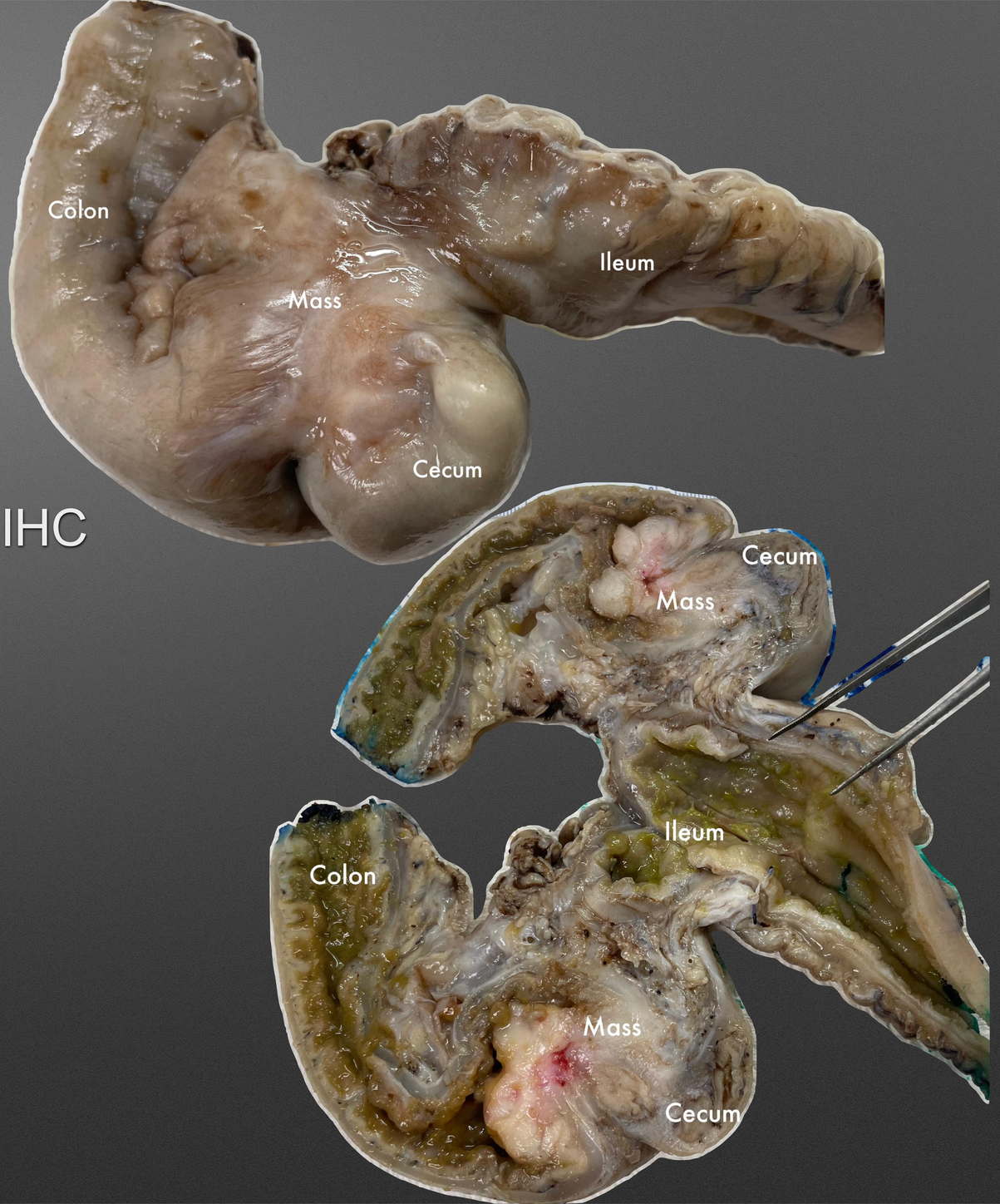
7-year-old Golden Retriever had diarrhea and occasional vomiting for 3-4 weeks. Blood noticed in diarrhea.



Outcome

- Went to surgery
- Histopath: malignant spindle cell tumor. IHC confirmed **leiomyosarcoma**





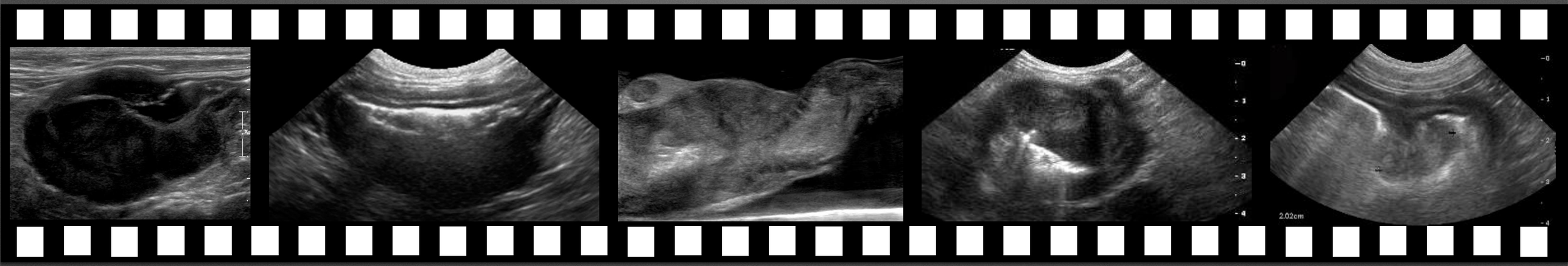
Take home message

	Location	Wall distribution	Layering/ length	obstructive	LN	ulceration	mineralization
Round cell tumors	Anywhere, 1 or more	Mostly concentric	Lost-long	uncommon	+++	+	-
Carcinoma	SI or colon	Concentric	Lost to Altered (stomach-colon?) Short	common	+++	+	+
Spindle cell tumors	Anywhere	Eccentric	~	uncommon	(-)	(-)	_

Questions ?

GI Nodules and Masses: Pseudo-tumors

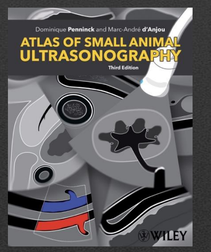
Part 2



Dominique Penninck, DVM, PhD, DACVR, DECVDI

Professor, Diagnostic Imaging, Tufts University

SmallAnimalUltrasonography.com & Atlas of Small Animal Ultrasonography, 2025



Non-neoplastic nodules/masses

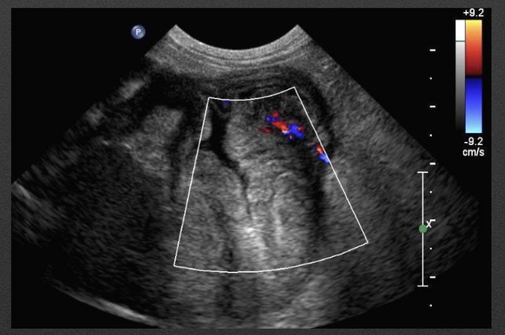
- Polyp/Adenomatous polyp
- Hypertrophic pyloric stenosis
- Feline Eosinophilic Sclerosing Fibroplasia
- Lipogranulomatous Lymphangitis
- Granulomas (infectious, post-trauma)

13-year-old (CM) toy poodle was presented for tetraparesis and progressive cough.
An abdominal ultrasound was performed as a baseline screening prior the MRI.

13-year-old (CM) toy poodle was presented for tetraparesis and progressive cough. An abdominal ultrasound was performed as a baseline screening prior the MRI.

Gastric polyp: marked, diffuse, mucosal hyperplasia with moderate, chronic, neutroph
and lymphohistiocytic gastritis with myriad bacteria

A 11-year-old Jack Russell Terrier with 8 weeks of diarrhea, polyphagia and weight loss. He has been vomiting 1-2 times/month for years (no progression)



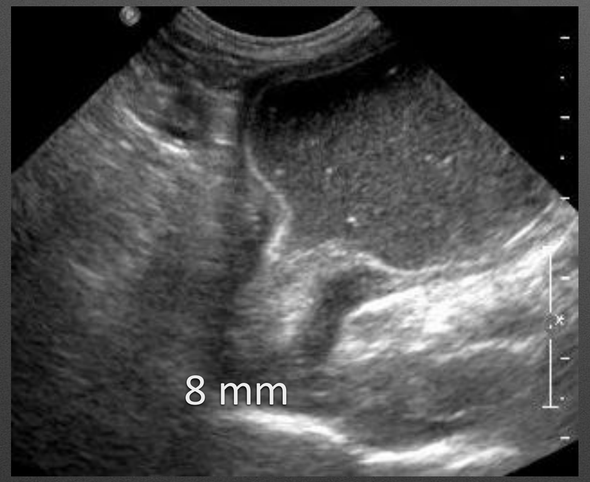
Ultrasonographic appearance of canine gastric polyps

Abstract

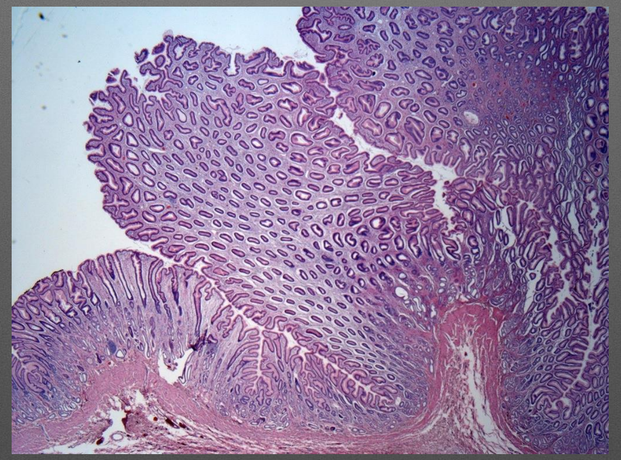
Benign gastric polyps are uncommon in dogs and most are discovered incidentally. Polyps protruding into the pyloric antrum can cause gastric outflow obstruction. Clinical and ultrasonographic findings in **seven dogs** with histologically confirmed benign mucosal gastric polyps were reviewed. Sonographic findings such as shape, size, echogenicity, location, evidence of gastric wall thickening, wall layering, and size of regional lymph nodes were recorded. Five sessile and two pedunculated masses of different sizes (range 7-60 mm) and echogenicities were found. They primarily arose from the mucosal layer and protruded into the gastric lumen. Only one dog had a large inhomogeneous mass with a poorly visualized gastric wall layering. The polyps were all single, and were located in **the pyloric antrum** in six out of seven dogs. Although the ultrasonographic appearance allowed a presumptive diagnosis of mucosal gastric polyp, the final diagnosis was determined from histopathologic examination.

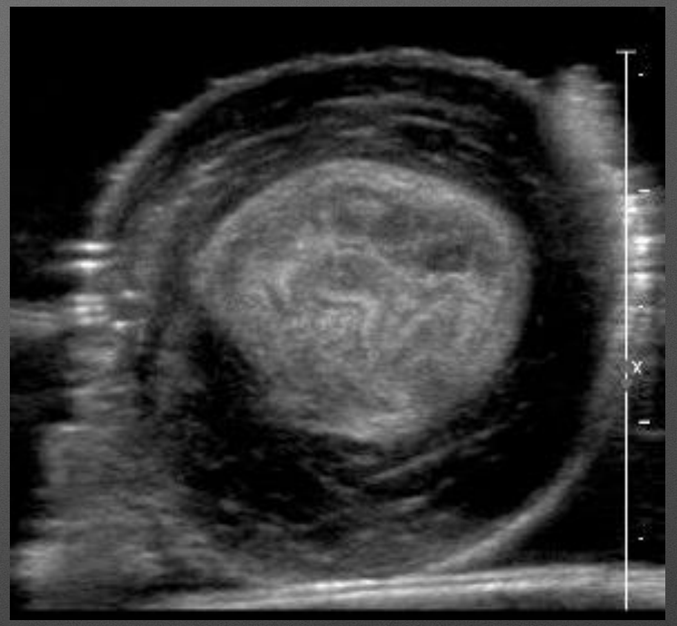
Diana A et al. Vet Radiol Ultrasound. 2009 Mar-Apr;50(2):201-4.

10-year-old Lhasa Apso, presented for chronic vomiting for 3 years (vomiting 1-2x/month). Increased lethargy and weight loss over last 6 months to 1 yr. Increased frequency of vomiting over last month, visually bloated to owner. A few days ago, the referral DVM did an ultrasound evaluation and noticed marked gastric fluid distention.



Comparison US water-bath & histopathology





Tubular adenomatous hyperplasia/adenoma with nodular hypertrophy of the tunica muscularis

1. Thickened muscular layer made of hypertrophied muscular fibers

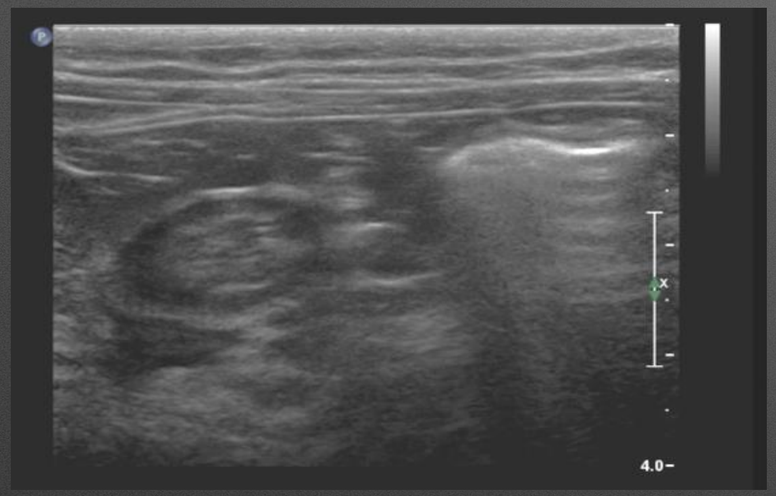
2. Mucosal hyperplasia and muscular hypertrophy

3.Mucosal hyperplasia with glandular+foveolar hyperplasia, glandular cystic dilation and various degrees of mucosal and submucosal inflammation

Biller DS. et al, Veterinary Radiology & Ultrasound 1994

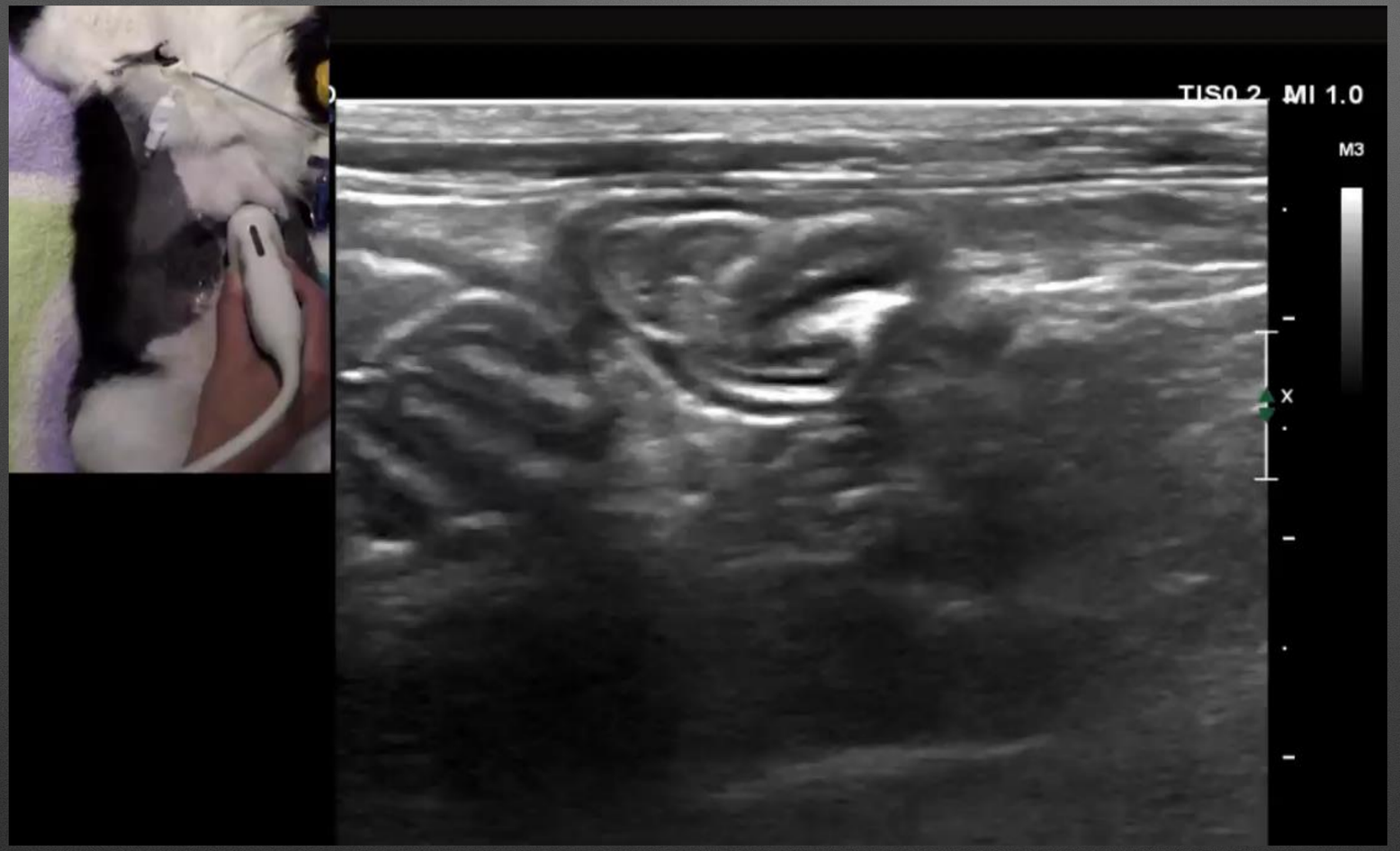
Adenomatous Polyp in Cats
Pyloro-duodenal region

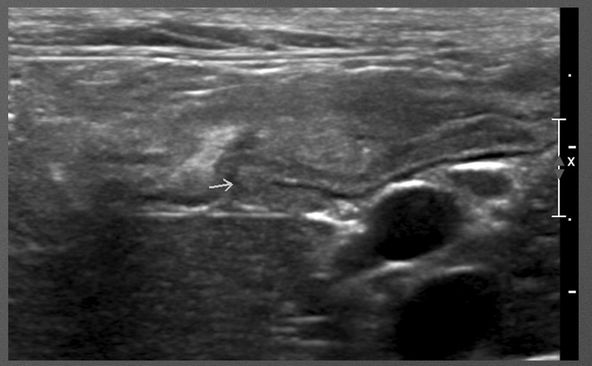
10-year-old ragdoll

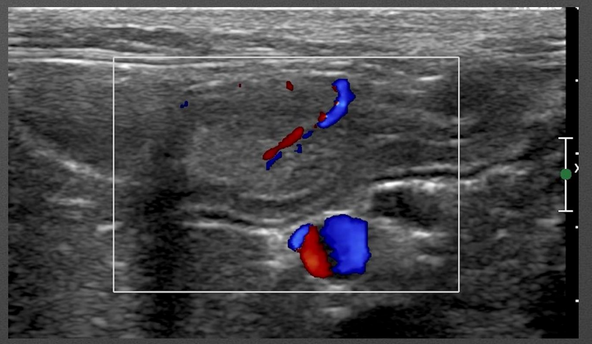


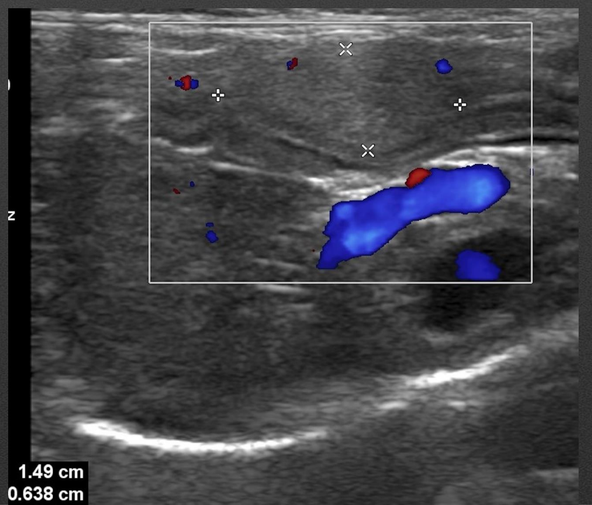
16-year-old cat with severe anemia and melena

Kira is a 2.5-year-old DSH, FS presented for acute lethargy and anorexia. She was hiding. She has very pale gums. On lab work, there is evidence of severe regenerative anemia (PCV 14%) with low total protein (4g/dl).









Ultrasonographic and clinicopathological features of pyloroduodenal adenomatous polyps in cats

Evence Daure[1], Rachel Jania[2], Samuel Jennings[3], Marc-André d'Anjou[4] and Dominique Penninck[1]

Journal of Feline Medicine and Surgery

Adenomatous polyps of the duodenum in cats: 18 cases (1985-1990)

Janet M. MacDonald, DVM; Holly S. Mullen, DVM; Scott D. Moroff, VMD

JAVMA, Vol 202, No. 4, February 15, 1993

Abstract

Objectives The aim of the study was to report the ultrasonographic and clinicopathological findings in cats with confirmed adenomatous pyloroduodenal polyps.

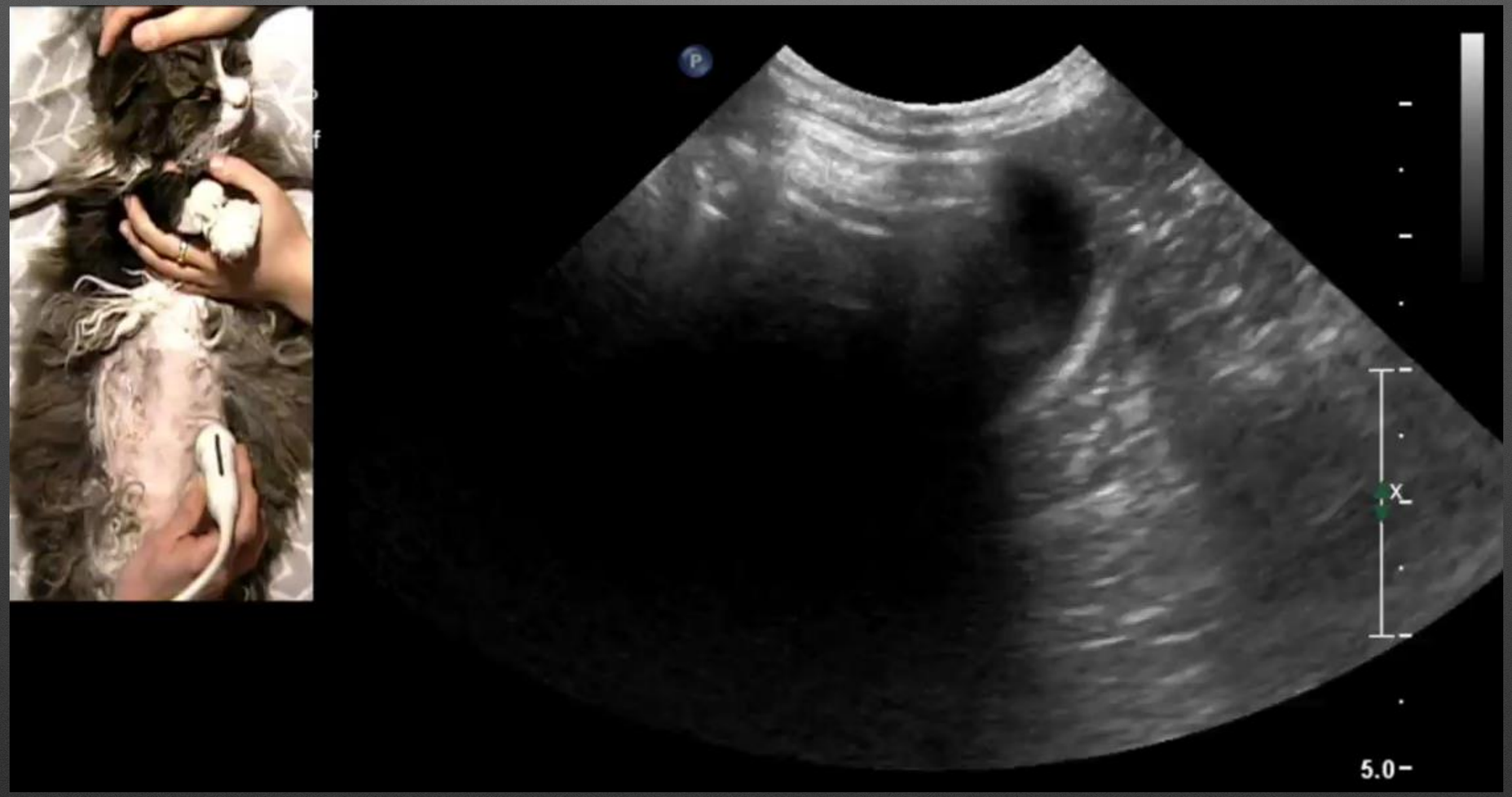
Methods Clinicopathological data, ultrasonographic and histopathological findings were collected retrospectively from medical records.

Results Pyloroduodenal polyps appeared as small moderately echogenic and homogeneous nodules filling most of the proximal duodenal or pyloroduodenal lumen. The most common presenting signs in this study included acute vomiting and anorexia in 4/6 cats and lethargy in 3/6 cats. Two cats presented with severe anemia, suggestive of active bleeding. One cat presented with increased bilirubin without anemia, suggestive of impaired bile flow. Five cats survived surgical removal of the polyp and were free of clinical signs 817 days after the procedure.

Conclusions and relevance Pyloroduodenal polyps have subtle ultrasonographic changes that can easily be mistaken for ingesta. They are characterized by a discrete small (up to 1.5 cm in diameter) homogenous echogenic nodule filling the pyloroduodenal lumen. Pyloroduodenal polyps are benign lesions but can cause severe clinical signs including gastrointestinal bleeding or biliary obstruction. Prognosis is excellent with surgical removal.

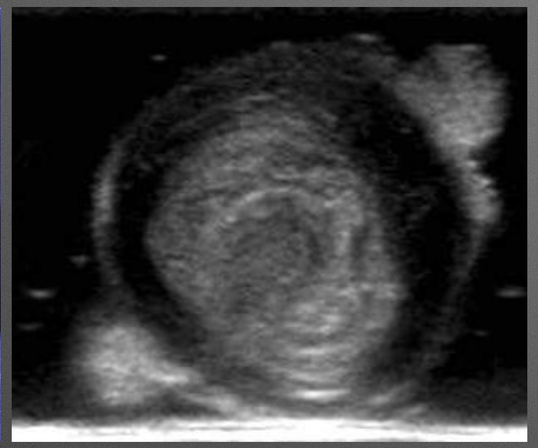
Journal of Feline Medicine and Surgery, 2015

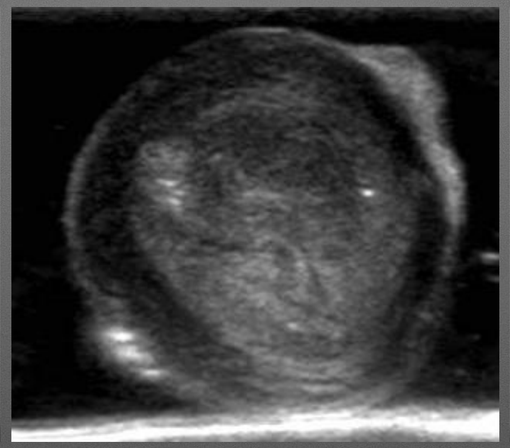
DSH cat, FS, 11-year-old was presented for 3-4 days of vomiting and lethargy. The cat was markedly dehydrated on presentation. History of CKD. Labwork: anemia, hypernatremia, hypokalemia, azotemia.



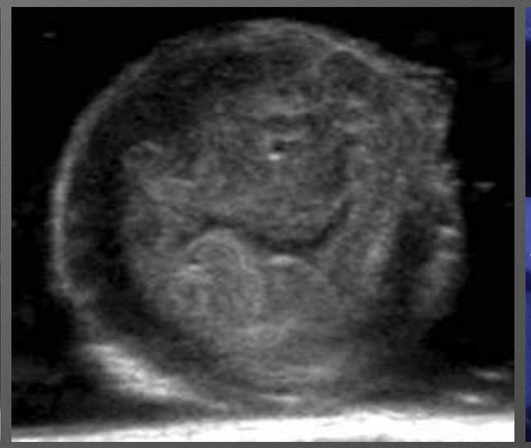
Pylorectomy was performed

Duodenal side

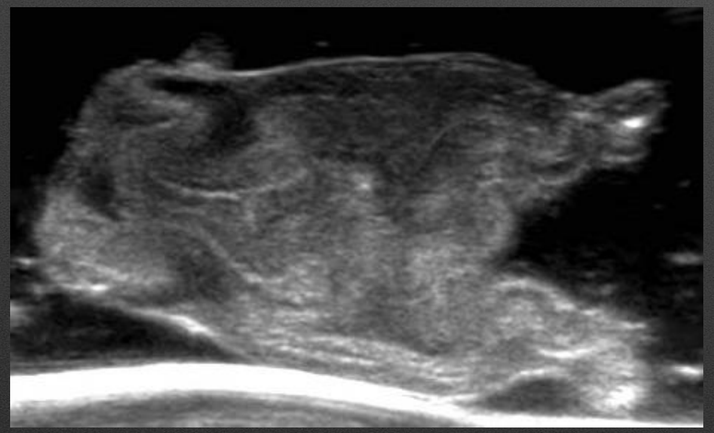


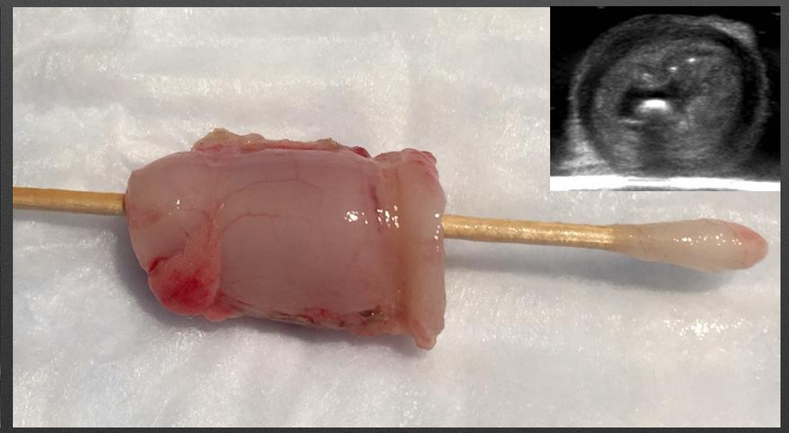


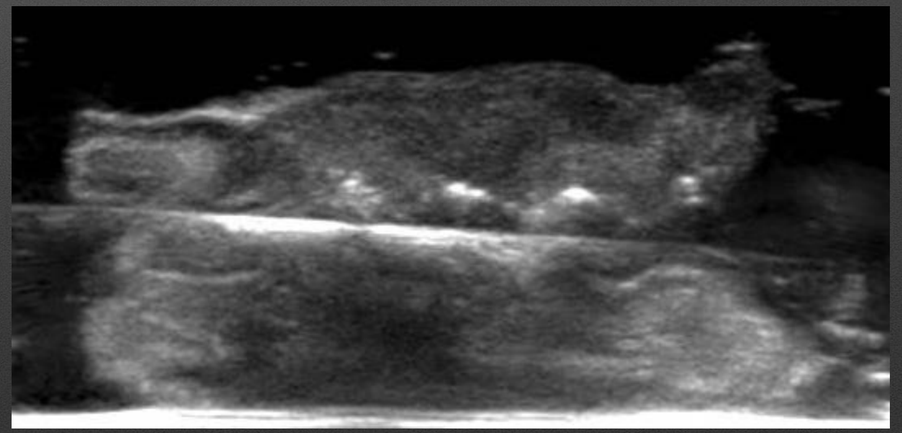
Specimen in water-bath



Pylorus side







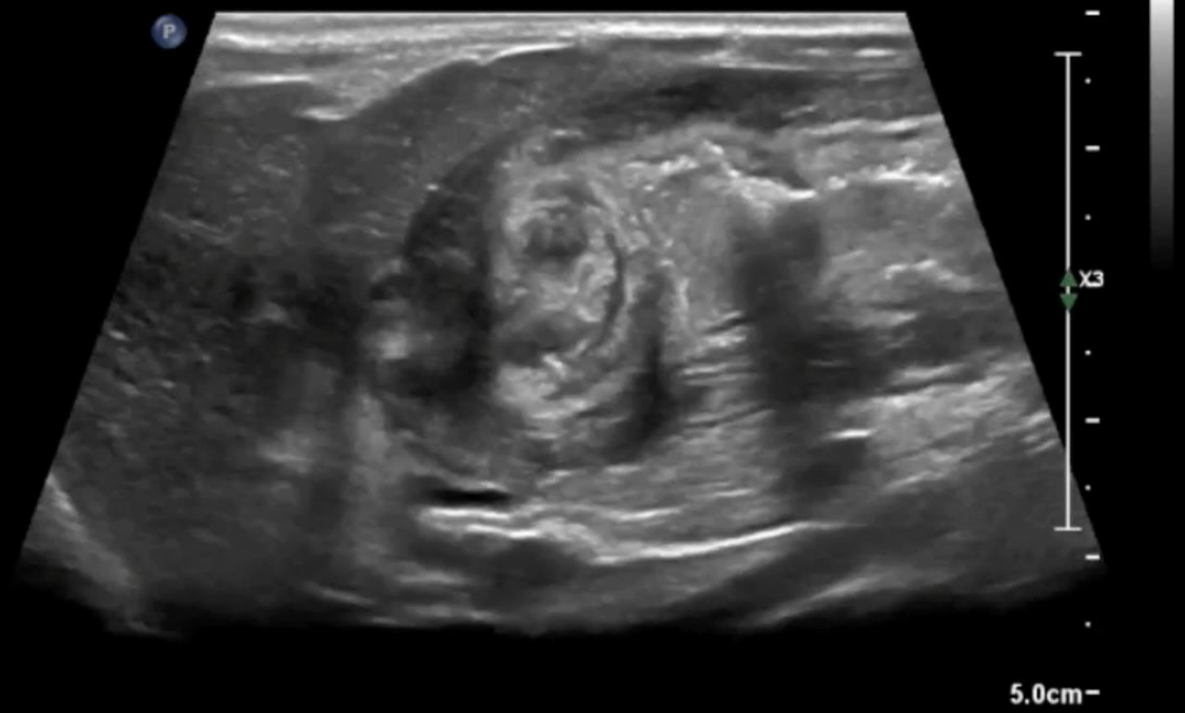
Outcome

Marked multifocal ulcerative gastritis with extensive granulation tissue

Comment: The main process occurring in this pylorus is ulceration, the cause of which is not clear but could be related to a number of common causes such as metabolic stress or NSAIDs. There were no neoplastic processes observed in this slide and no evidence to suggest eosinophilic sclerosing fibroplasia.

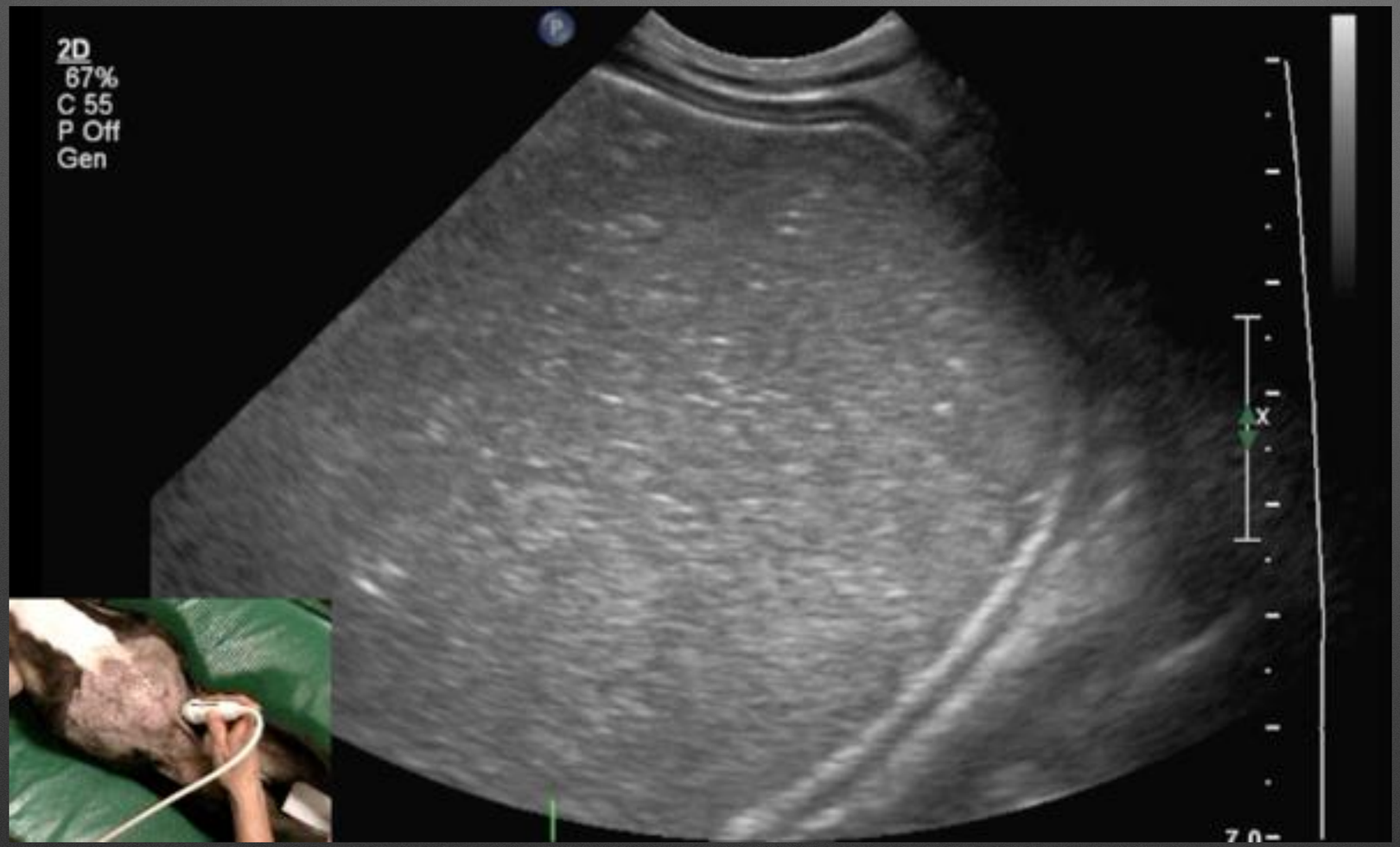
4-month-old French Bulldog with regurgitation, getting progressively worse

A large polyp with an undulated hyperechoic margin is present along the ventral antral wall.

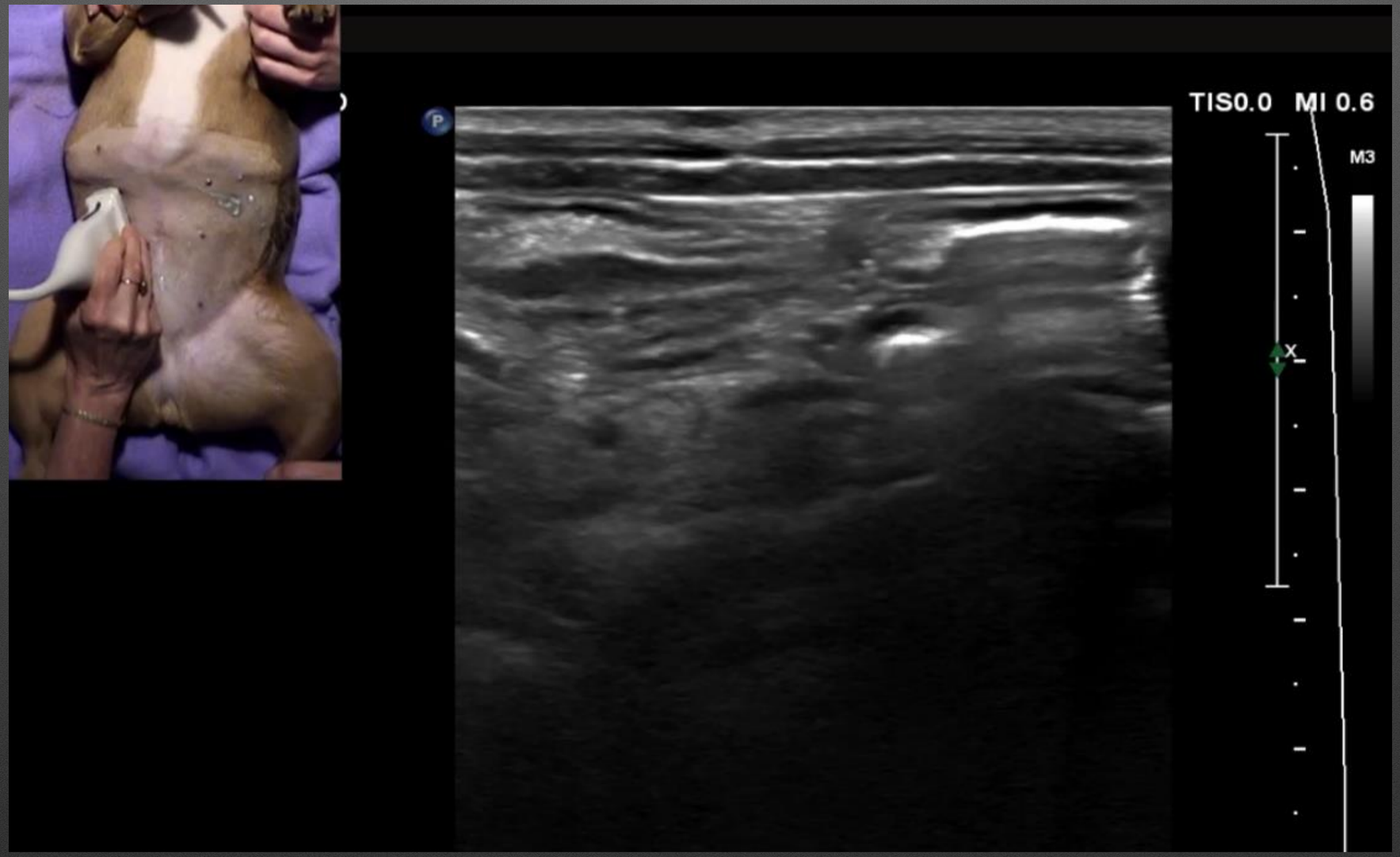


https://smallanimalultrasonography.com/time-to-play-31-the-answer/

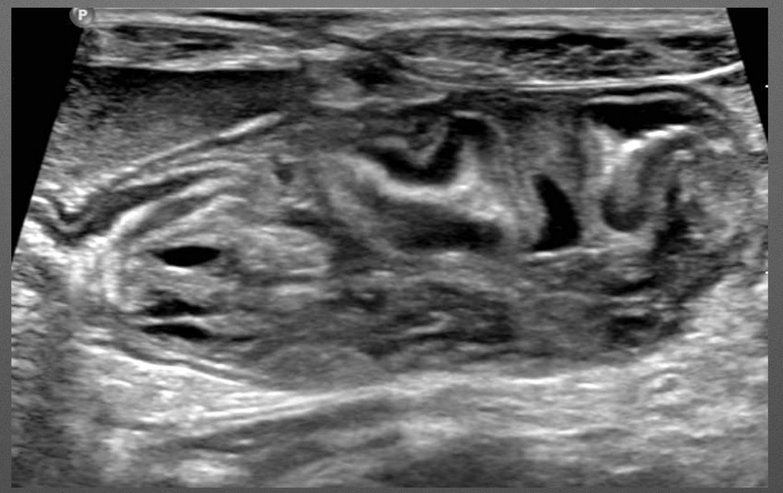
2-year-old French Bulldog with a history of chronic vomiting

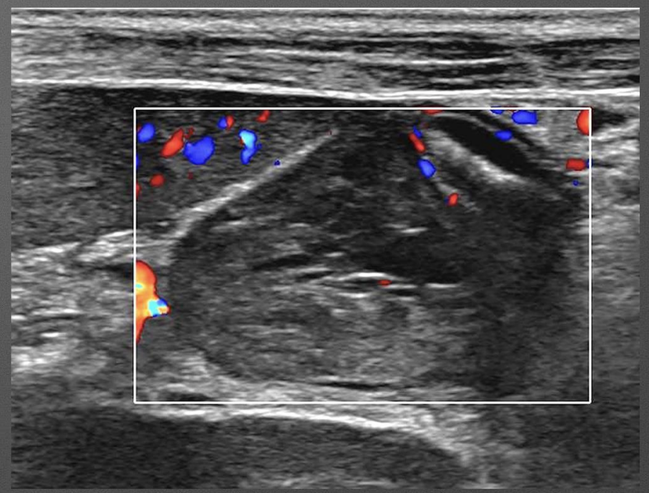


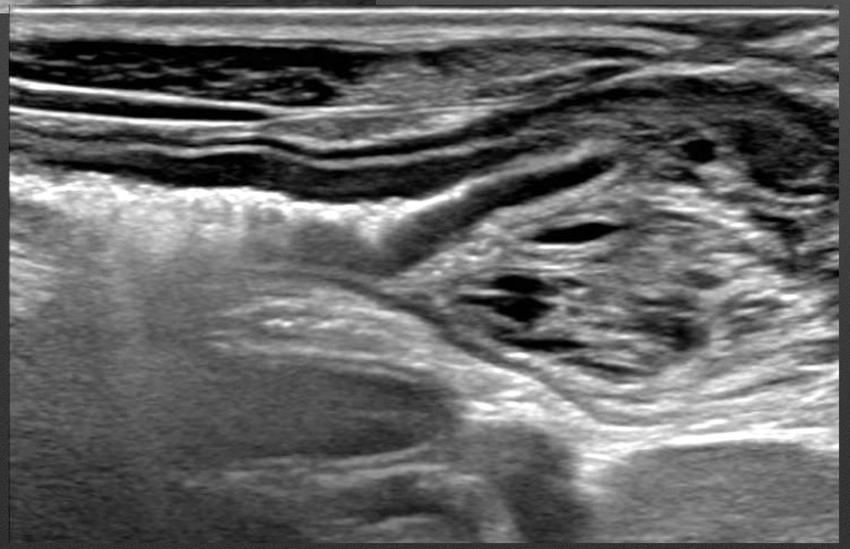
Olive is a 2-year-old French Bulldog presented for anorexia, vomiting, abdominal pain. She was not responding to primary care management.



Key Findings







Outcome

At surgery, a 10 cm long thickened jejunal segment was resected.

Histopathology: lipogranulomatous lymphangitis with extensive intramural hemorrhage

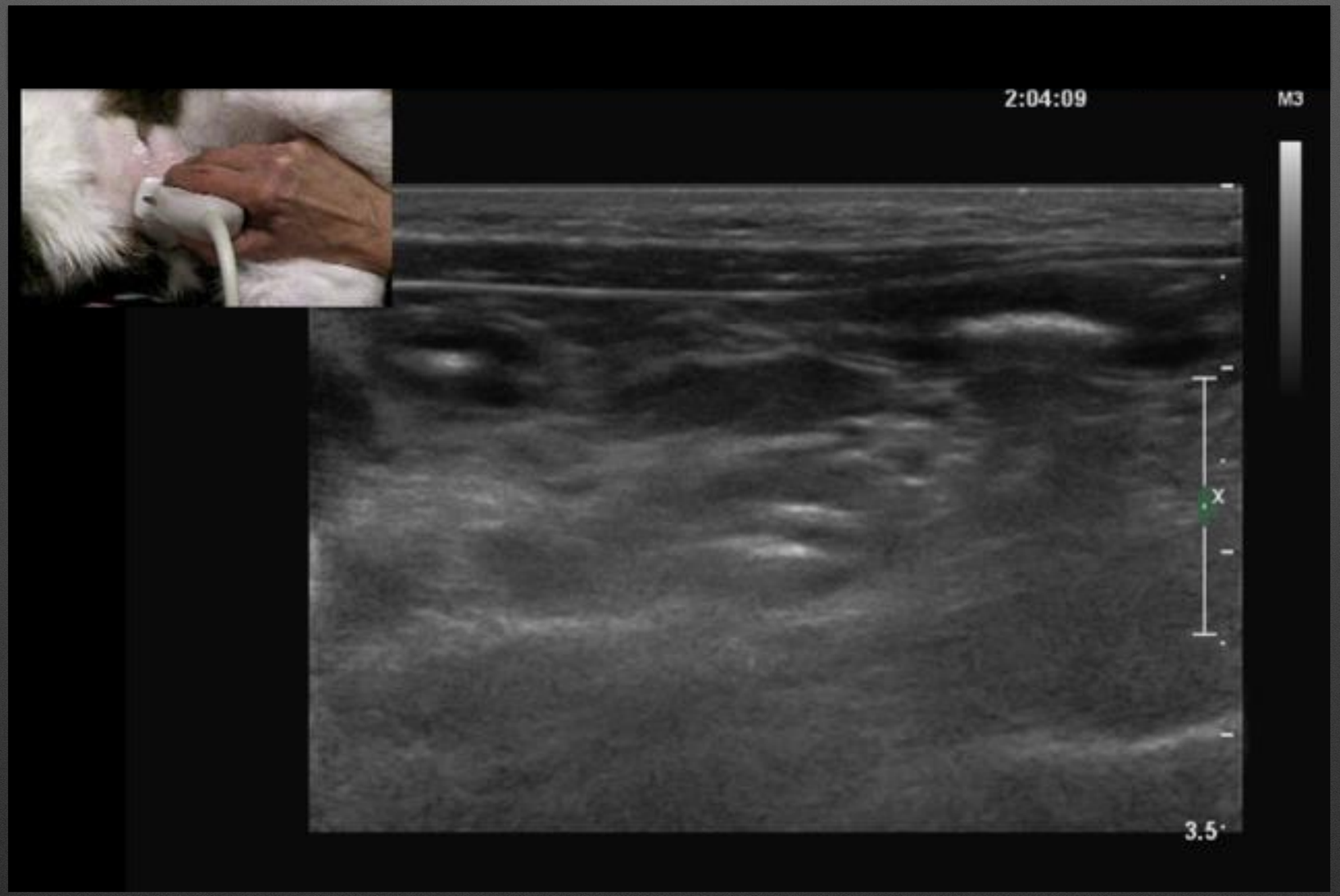
US features of lipogranulomatous lymphangitis in 10 dogs

Abstract

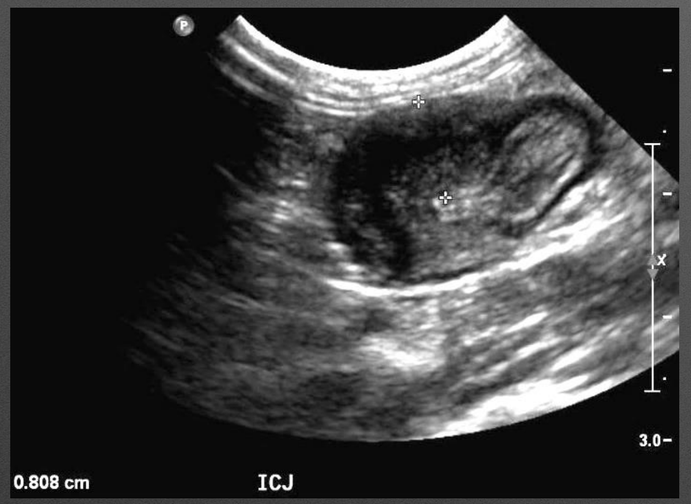
Intestinal lipogranulomatous lymphangitis (ILL) is a granulomatous inflammation of the lymphatic vessels of the intestinal wall and mesentery characterized by lipogranulomas. The purpose of this retrospective, multi-center, case series study is to report the ultrasonographic features of canine ILL. Ten dogs with a histologically confirmed ILL undergoing preoperative abdominal ultrasound were retrospectively included. Additional CT was available in two cases. Lesion distribution was focal in eight dogs and multifocal in two. All dogs presented with intestinal wall thickening and two had a concomitant mesenteric mass adjacent to the intestinal lesion. All lesions were in the small intestine. Ultrasonographic features were altered wall layering with predominantly muscular and to a lesser extent submucosal layer thickening. Other findings included hyperechoic nodular tissue within the muscular, serosa/subserosal, and mucosal layers, hyperechoic perilesional mesentery, enlarged submucosal blood/lymphatic vessels, mild peritoneal effusion, intestinal corrugation, and mild lymphadenomegaly. The two intestinal to mesenteric masses presented heterogeneous echostructure, predominantly hyperechoic with multiple hypo/anechoic cavitations filled with mixed fluid and fat attenuation content on CT. Histopathological findings included lymphangiectasia, granulomatous inflammation, and structured lipogranulomas affecting mainly submucosa, muscularis, and serosa. The intestinal to mesenteric cavitary masses revealed severe granulomatous peritonitis with steatonecrosis. In conclusion, ILL should be considered as a differential diagnosis for dogs with this combination of ultrasonographic features.

DeMagistris A. et al. Vet Radiol Ultrasound, 2023

A 4-year-old DSH presented for several weeks of inappetence and weight loss. He has hyperalbuminemia.

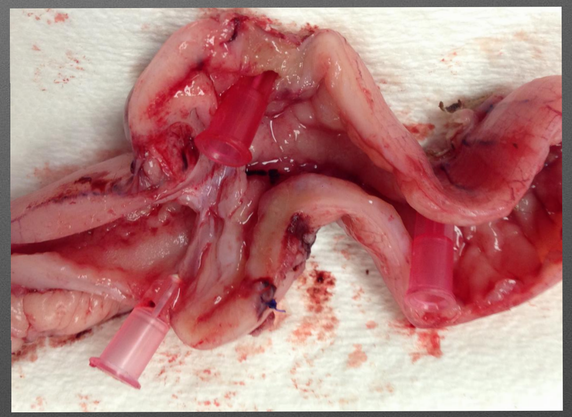


Key Findings



Outcome

FNAs: non conclusive diagnosis, no evidence of neoplasia



Surgery: ileum, cecum, proximal colon resection

Histopathology: marked, multifocal to coalescing, transmural, pyogranulomatous enterocolitis and lymphadenitis.

Immunohistochemistry for feline coronavirus has positive staining, confirming Feline Infectious Peritonitis

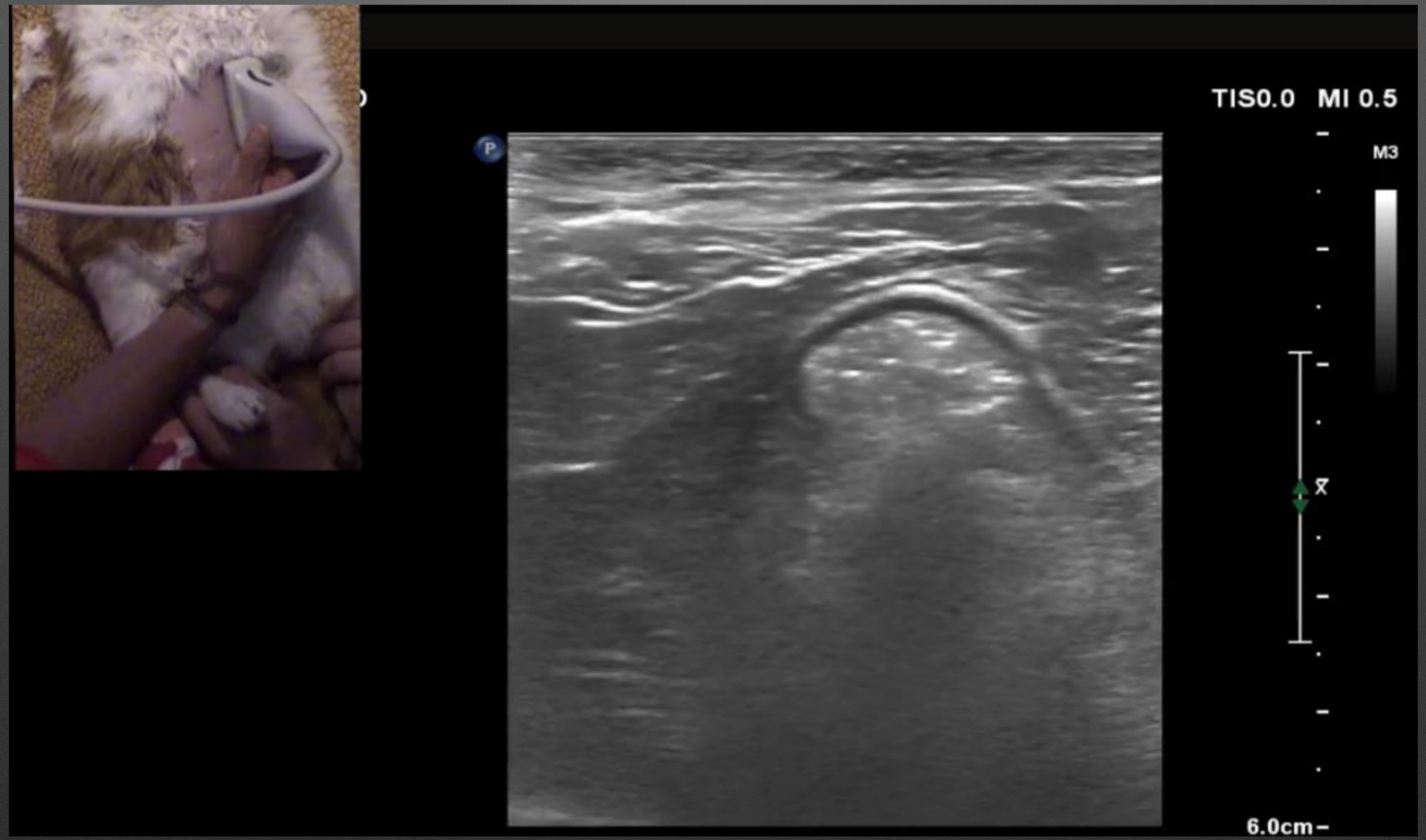
The abdominal ultrasonographic findings of cats with FIP: an update

In total, **25 cats** were included. Common clinical signs/pathology findings included hyperglobulinemia (96%), anorexia/hyporexia (80%) and lethargy (56%).

Abdominal ultrasound findings included effusion in 88% and lymphadenopathy in 80%. Hepatic changes were noted in 80%, the most common being hepatomegaly (58%) and a hypoechoic liver (48%). **Intestinal changes were noted in 68%** of cats, characterized by **asymmetric wall thickening and/or loss of wall layering**, with **52% being ileocecocolic junction and/or colonic in location**. Splenic changes were present in 36% of cats, including splenomegaly, mottled parenchyma and hypoechoic nodules. Renal changes were present in 32%, encompassing a hypoechoic subcapsular rim and/or cortical nodules. Mesenteric and peritoneal abnormalities were seen in 28% and 16% of cats, respectively. Most cats (92%) had two or more locations of abdominal abnormalities on ultrasound.

Müller T, Penninck D, Webster CRL, Conrado F JFMS 2023

14-year-old cat with chronic (years!) vomiting but in more recent weeks is hyporexic .



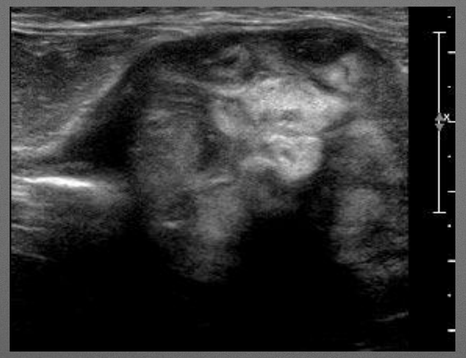
Outcome

Surgical resection of the ICJ/ileal mass

Histopathology: **feline eosinophilic sclerosing fibroplasia**

Had also concurrent intestinal small cell lymphoma (duod-jej)

10-year-old Ragdoll cat with acute onset of large bowel diarrhea and vomiting 2-3x/day



- Unique intramural inflammatory mass within the feline GI tract
- Eosinophilic inflammation, large reactive fibroblasts, and trabeculae of dense collagen. Often, bacteria (cocci) are found.
- Lesion was often grossly and sometimes histologically mistaken for neoplasia.

US and Clinicopathological Features of Feline Eosinophilic Sclerosing Fibroplasia in 4 Cats

Andrea Weissman[1], Dominique Penninck[1], Cynthia Webster[1], Silke Hecht[2], John Keating[1] and Linden E Craig[2]

Abstract

Four cats with feline gastrointestinal eosinophilic sclerosing fibroplasia (FGESF) are described. Clinical signs included decreased appetite, weight loss, vomiting and diarrhea. Bloodwork abnormalities included mild neutrophilia (n = 2) and hyperglobulinemia with concurrent hyperproteinemia (n = 2). Ultrasonographically, a total of five solitary masses with mural thickening and loss of layering were identified in the stomach, duodenum, jejunum and colon. In one cat a second, separate lesion was diagnosed 3 weeks following surgical resection of one mass. Histopathologically, lesions were characterized by collagen trabeculae and mixed inflammatory cell infiltrates, predominantly eosinophils. Multiple areas of necrosis were also noted, which contained bacteria in 2/4 cats. In two cats, changes consistent with FGESF were also noted in the liver. All cats had surgical resection of their lesions. Two cats are still living at time of publication (43 and 24 months post-surgery). FGESF should be considered as a differential for intestinal masses in cats.

J Feline Med Surg, 2013

Craig et al in Vet Pathol 46(1):63-70, 2009

Feline eosinophilic sclerosis fibroplasia

this entity should be added to the differential diagnoses list in cats with focal and inhomogeneous intestinal masses, especially if fine-needle aspirates or biopsies reveal the presence of eosinophilic inflammation, mast cells and fibroblasts

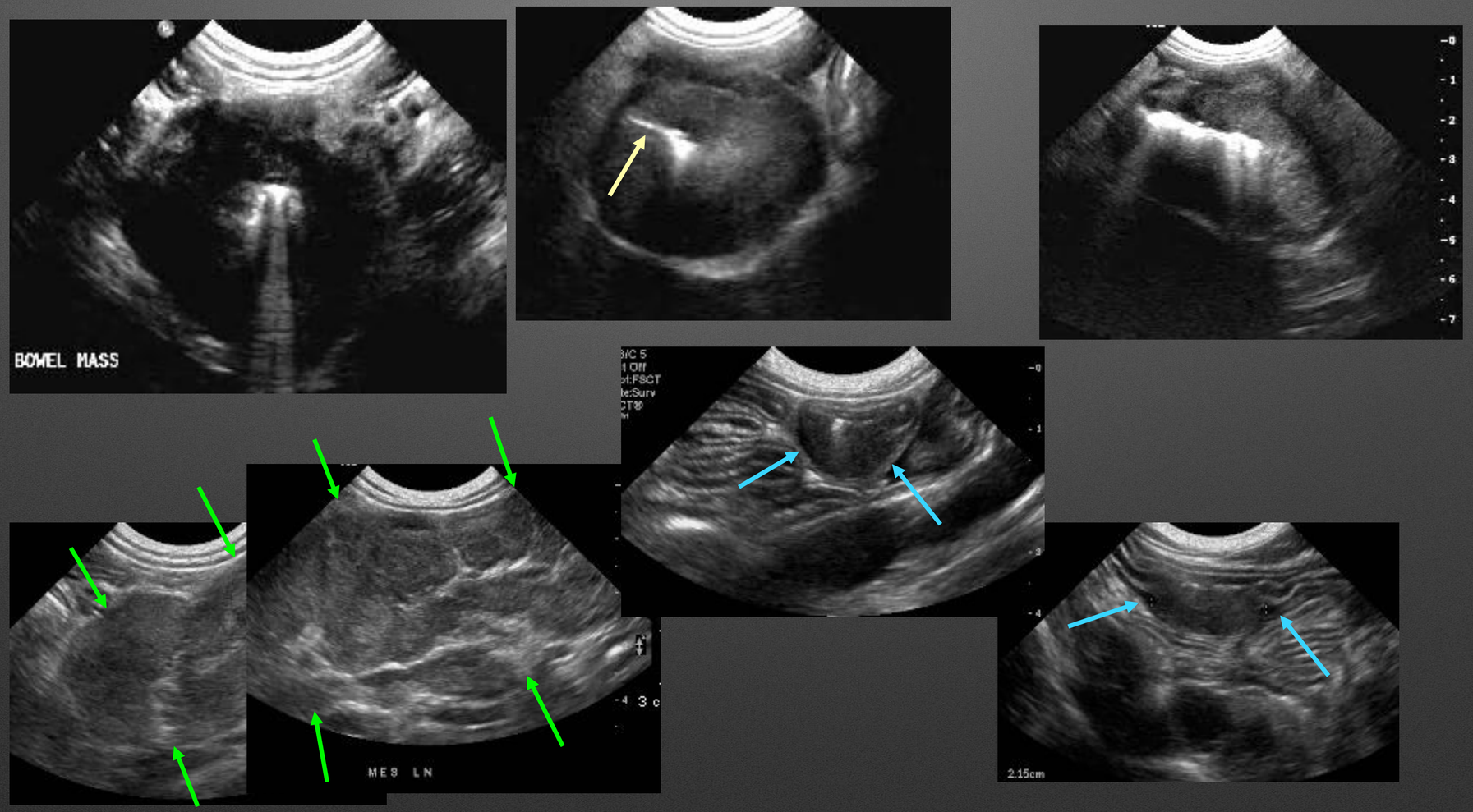
Clinicopathological findings, treatment, and outcome in 60 cats with GI eosinophilic sclerosing fibroplasia

Results: The median age was 5.4 years (interquartile range [IQR], 3.3-8.9.); 30% were Domestic Shorthairs and 12% were Domestic Longhair cats, with the most prevalent pedigree breeds being Ragdolls (25%), Exotic Shorthair (10%) and Persian (8%) cats. The median duration of clinical signs was 90 days (IQR, 17.5-247.0); the most common clinical signs were weight loss (60%), hyporexia/anorexia (55%), chronic vomiting (37%), lethargy (35%) and chronic diarrhea (27%). Masses were located in the small intestine (32%), stomach (27%), ileocolic junction (15%), colon (10%), lymph node (8%) and mesentery (8%) and 15% of cats had >1 mass. Eosinophilia was present in 50% and hypoalbuminemia in 28% of cats. The mass was removed surgically in 37% of cases. Most cats (98%) were treated with corticosteroids. Survival was not statistically different between cats treated with surgical resection and cats treated with medical therapy alone, 88% of the cats were still alive at the time of writing.

Conclusions and Clinical Importance: GESF is an important differential diagnosis for abdominal masses in cats, and has a much better prognosis than previously reported.

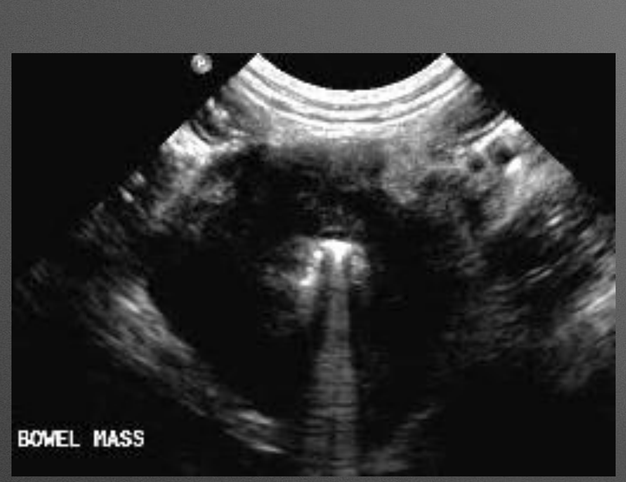
Cerná P. et al. J Vet Intern Med 2024

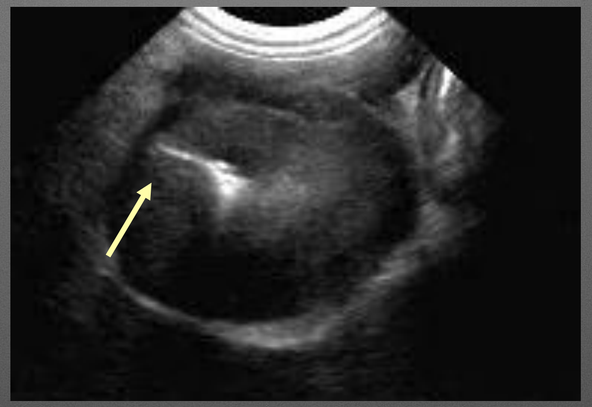
Multi-segmental Changes

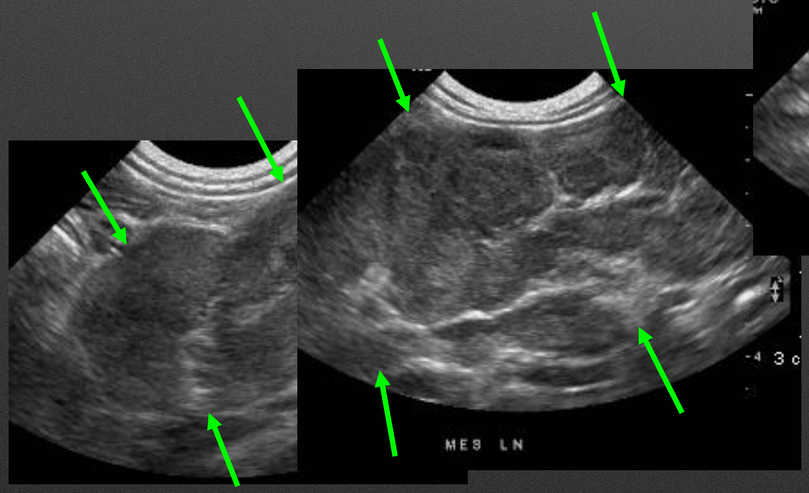


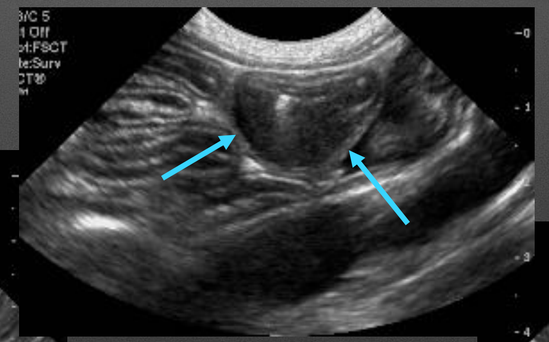
S171543

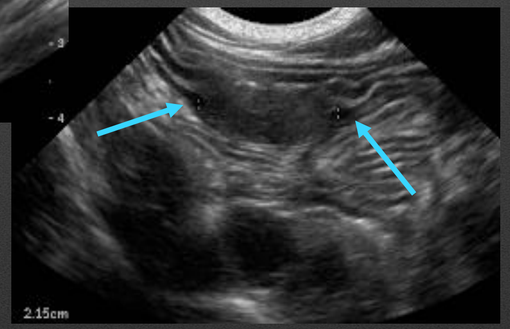
Granulomatous Enteritis (Cryptococcus)











S171543

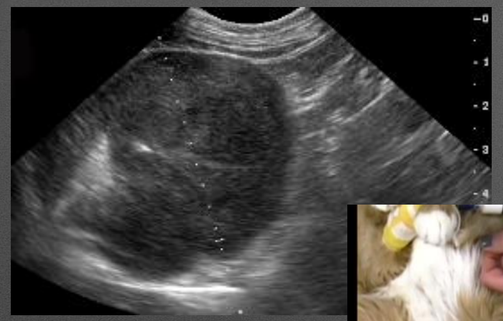
ULTRASONOGRAPHIC FEATURES OF CANINE GASTROINTESTINAL PYTHIOSIS

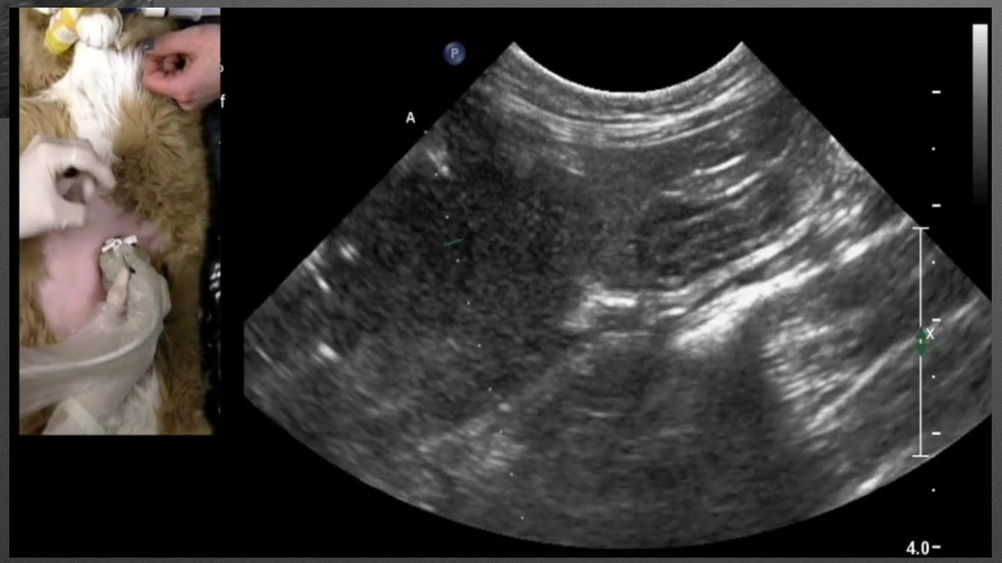
JOHN P. GRAHAM, MVB, MSc, SUSAN M. NEWELL, DVM, MS, GREGORY D. ROBERTS, DVM, MS, NOLA V. LESTER, BVMS

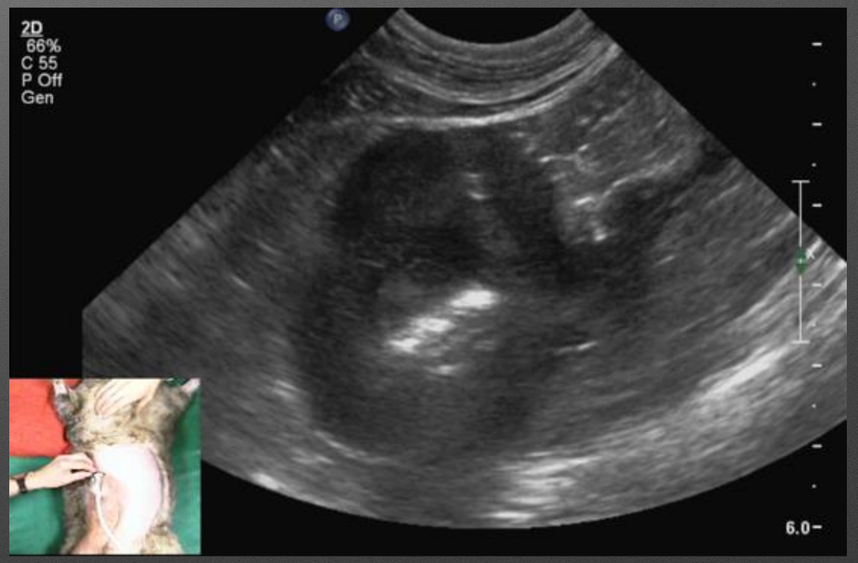
Pythiosis is a chronic pyogranulomatous infection of the gastrointestinal tract or skin caused by the water borne pathogen *Pythium insidiosum*. The ultrasonographic features of nine dogs with gastrointestinal pythiosis are reported. The stomach, duodenum, jejunum or colon were affected. All dogs had thickening of the gastrointestinal wall and areas with obliteration of the normal layered appearance. In one dog an eccentric mass was found arising from the serosal surface of the wall of the colon with mild diffuse wall thickening. Regional lymph node enlargement was seen in seven of the nine dogs. One dog had invasion of the pancreas and signs compatible with extrahepatic biliary obstruction. When compared to previous reports of gastrointestinal neoplasia, the features of wall thickening, loss of layering and regional lymphadenopathy are not considered specific for gastrointestinal pythiosis. Histological examination of tissue specimens is required for diagnosis. *Veterinary Radiology & Ultrasound, Vol. 41, No. 3, 2000, pp 273–277.*

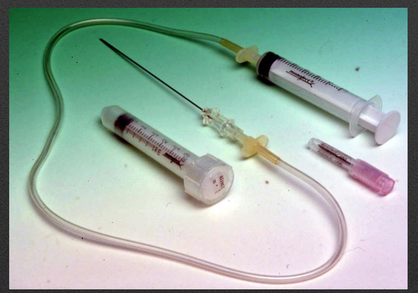
Importance of Sampling

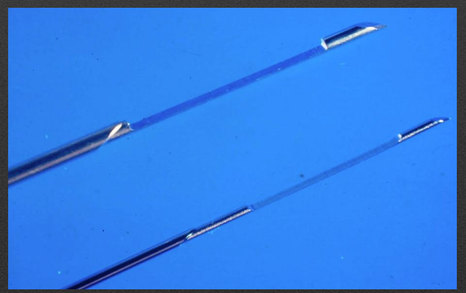
- Fine needle aspiration
- Core biopsy











Take home message…

- Signalment, clinical history
- Geography
- Morphology of lesion(s), especially mixed/hyperechogenicity
- Nodules and masses are not all tumors!

Questions?