

## Most common diseases requiring abdominal ultrasonography in dogs: point of view of the Internal Medicine specialist

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- The Internal Medicine specialist is frequently challenged with diseased dogs with non-specific clinical signs. In this case, different tools are needed to obtain a correct diagnosis and provide treatment recommendations.
- First, a history, a thorough clinical examination, blood work, and urinalysis are necessary.
- Then, to entirely clarify the clinical picture, further investigations are required, particularly diagnostic imaging tests such as radiographs and ultrasonography.
- Before starting the ultrasonographic examination, the Internal Medicine specialist must communicate the clinical suspicion to the radiologist to optimize the subsequent investigation.
- Here, the abdominal organs are described to provide the most relevant information that helps complete the patient's diagnostic workup from the perspective of the Internal Medicine specialist.

**Abdominal ultrasonography is extremely valuable in dogs, because it provides a large quantity of information in real-time, is non-invasive, and is cost-effective.**

### GASTROINTESTINAL TRACT

Ultrasonography of the gastrointestinal tract is often requested by the Internal Medicine specialist because among the most frequent presenting complaints of dogs are anorexia, vomiting, diarrhoea, and weight loss. Major focuses of ultrasonography are the stomach's lumen, the pylorus's patency, the gastric and intestinal wall thickness, stratigraphy, and peristalsis. Unfortunately, due to intraluminal gas, the ultrasonographic examination can be suboptimal.

In a dog with vomiting, it is important to exclude the presence of gastric distension with liquid content that can result from gastric atony caused by, for instance, hypercalcemia or pancreatitis or from an obstruction to the pyloric outflow. In addition, foreign bodies can cause obstructions to the transit of the ingesta at the pyloric level, neoplasia, and stenosis. (Image 1.A.)

Another possible finding in dogs with vomiting is a thickening of the gastric wall due to gastritis or neoplasia. The distribution, extent of thickening, and the involved layer might help

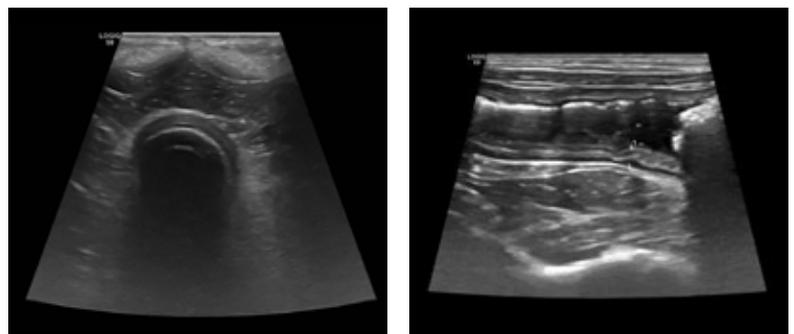


Image 1. A. Foreign body in the small intestine of a dog.

differentiate these conditions. However, further diagnostic procedures are usually required to achieve a definitive diagnosis, such as ultrasound-guided biopsies or endoscopy.

In dogs with haematemesis, haematochezia, or melaena, it is important to look for gastric or intestinal ulcers or masses. (Image 1.B.) Ultrasonography of the gastrointestinal tract is also useful for excluding small and large bowel obstructions and intussusceptions.

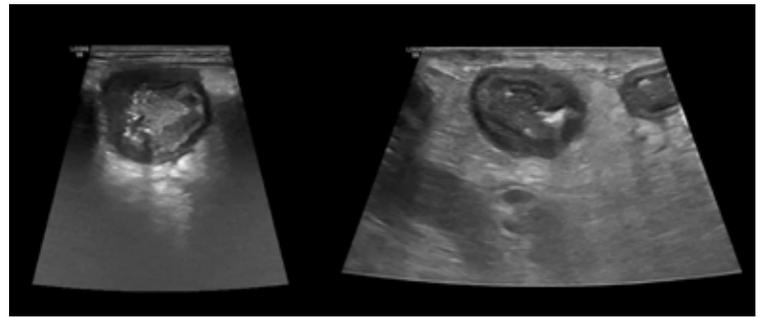


Image 1. B. Duodenal ulcer in a dog.

In dogs with chronic diarrhoea and weight loss, ultrasonography can be useful to exclude diffuse or focal intestinal wall thickening attributable to inflammatory or neoplastic disorders.

## ADRENAL GLANDS

The Internal Medicine specialist often needs the evaluation of the adrenal glands in dogs in which hypoadrenocorticism or hyperadrenocorticism is suspected. For these disorders, the diagnosis is initially based on a plethora of compatible clinical signs and laboratory findings, as well as endocrine tests (e.g., ACTH stimulation test). In addition, ultrasonography is very important to support the diagnostic suspicion; the size of the adrenal glands is assessed, obtaining different measurements such as the transverse thickness or the presence of any masses.

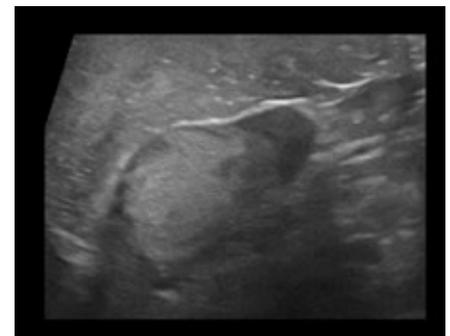


Image 2.A Adrenal tumor in a dog.

Bilateral enlargement of the adrenal glands may suggest pituitary hyperadrenocorticism, while in the presence of mild and unilateral increase of thickness, it is difficult to differentiate the underlying condition. Adrenal tumors can appear as masses or cause an increase in the overall size of the gland; they are mainly represented by adenomas, carcinomas, pheochromocytomas, and metastatic tumors. (Image 2.A.) If the tumor is secreting excess cortisol, the contralateral adrenal gland may be atrophic; this finding is highly specific.

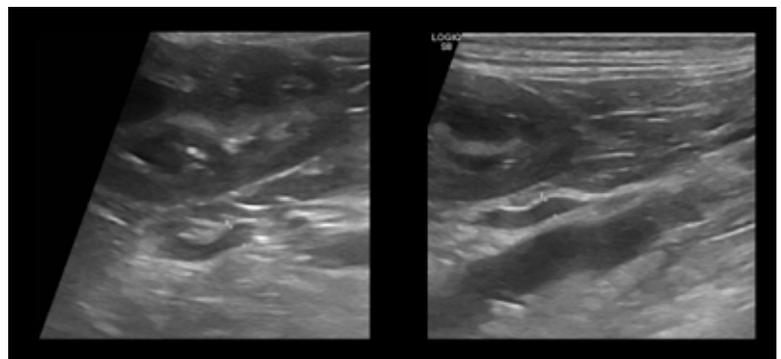


Image 2.B. Small adrenal gland in a dog.

In cases of hypoadrenocorticism, the bilateral reduction of the adrenal thickness is very common and, again, very specific. (Image 2.B. and 2.C.)

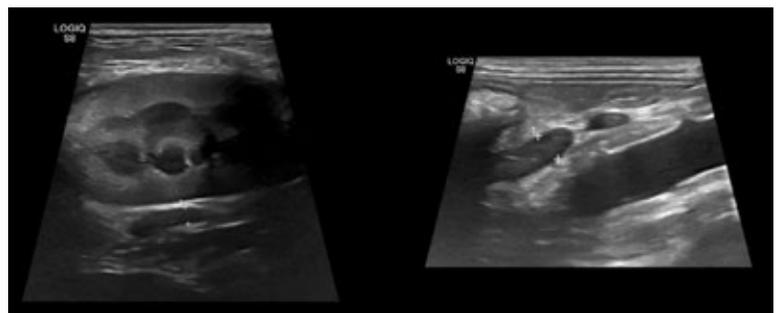


Image 2.C Small adrenal gland in a dog.

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## SPLEEN

An ultrasonographic examination of the spleen is useful in dogs for evaluating its size, parenchyma, and vascularization. The presence of splenomegaly may indicate infiltrative disorders (e.g., lymphoma), inflammation (i.e., splenitis), hyperplasia (e.g., due to chronic ehrlichiosis), or venous congestion. Heterogeneous parenchyma and the presence of focal lesions can suggest either a tumor or non-tumoral processes. Because in most cases the findings are non-specific, an ultrasound-guided biopsy of the organ is essential to differentiate the disorders. The splenic veins are also evaluated during ultrasonography to exclude the presence of thrombosis (e.g., due to torsion, protein-losing nephropathy). (Image 3.)

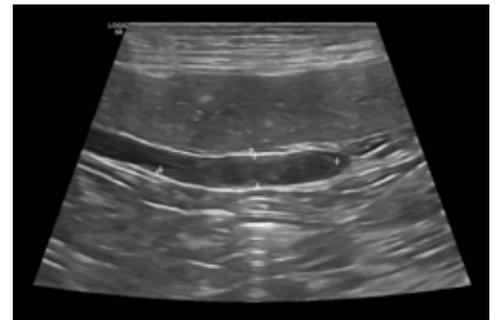


Image 3. Splenic vein thrombosis in a dog.

## LIVER & GALLBLADDER

An ultrasonographic examination of the liver is of particular importance to clarify some clinical signs such as anorexia, vomiting or diarrhoea, abdominal pain, jaundice, or any increase in circulating liver enzymes in dogs. With ultrasonography, it is possible to evaluate its size, echogenicity, vascularization, and any alterations in the parenchyma. The parenchyma evaluation helps identify inflammatory processes, hyperplastic nodules, cysts, hematomas, abscesses (which are rare), and tumors. Due to the limited specificity of most features, it is often advisable to perform ultrasound-guided biopsies of the organ to characterize the lesions better.

Reasons to investigate the gallbladder are represented by jaundice or increased liver enzymes, particularly ALP and GGT. Through ultrasonography, biliary tract obstruction due to mucocele and, less often, to stones or tumors can be identified. (Image 4.A.) Thickening of the bile gallbladder may suggest cholecystitis. In the latter case, the Internal Medicine specialist can ask to collect a bile sample through ultrasound-guided fine-needle aspiration for bacteriology and cytology; the procedure, performed under sedation, is safe in most cases.

The liver vasculature is also important from the Internal Medicine perspective. For example, portosystemic shunts are relatively frequent in dogs, whereas arteriovenous fistulas are definitely rare. (Image 4.B.) In the former case, the Internal Medicine specialist can suspect the vascular abnormality based on, among the others, decreased liver function parameters (e.g., albumin, cholesterol) and abnormal liver function tests (e.g., increased post-prandial bile acids).



Image 4.A. Mucocele in a dog.



Image 4. B. Portosystemic shunt in a dog.

## PANCREAS

Diseases of the exocrine pancreas can cause non-specific clinical signs in dogs, such as vomiting, diarrhoea, and a painful abdomen. The ultrasonographic abnormalities can be focal (e.g., nodular hyperplasia, cysts, abscesses) or diffuse (i.e., pancreatitis); however, neoplasia is uncommon and is usually focal (e.g., adenocarcinoma) rather than diffuse.

The most frequently diagnosed disorder is acute pancreatitis, which can be suspected if the organ has reduced echogenicity, heterogeneous parenchyma, mild peritoneal effusion, or peri-pancreatic steatitis. (Image 5.)

In many cases, a normal ultrasonographic appearance of the pancreas does not rule out acute pancreatitis. Of note, also laboratory analyses, including canine-specific pancreatic lipase assay, are normal in some cases; hence, confirming acute pancreatitis in dogs can be a real challenge. However, by combining clinical, laboratory, and ultrasonographic findings, most affected dogs can be correctly identified.

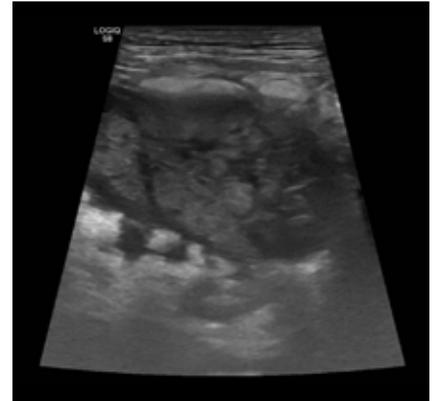


Image 5. Acute pancreatitis in a dog.

## KIDNEY & URINARY TRACT

Diseases of the kidney or urinary tract are suspected in dogs with pollakiuria, stranguria, anuria, incontinence, polyuria, polydipsia, or haematuria. In addition, the biochemical profile and urinalysis may unveil, among the others, increased circulating creatinine and urea, diluted urine, or proteinuria.

In puppies and young dogs with polyuria and polydipsia, congenital disorders can be identified, such as ectopic ureters and, rarely, renal dysplasia. In the former, the dilated ureters are easily identified with ultrasonography; in the latter, abnormally shaped kidneys with loss of cortico-medullary definition can be observed. (Image 6.A.)

Ultrasonography makes it possible to easily detect any renal parenchymatous masses, even if their appearance generally does not allow the definitive diagnosis. The neoformations can be fluid-filled (e.g., renal cysts) or solid (e.g., hematomas, granulomas, abscesses, primary or metastatic neoplasia). Acute kidney injury is diagnosed based on clinical and laboratory findings, and kidney ultrasonography may be normal in several of those

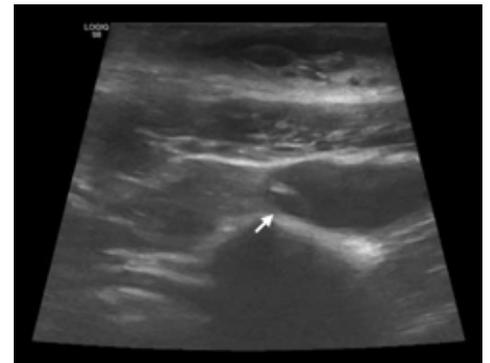


Image 6.A. Ectopic ureter in a dog.

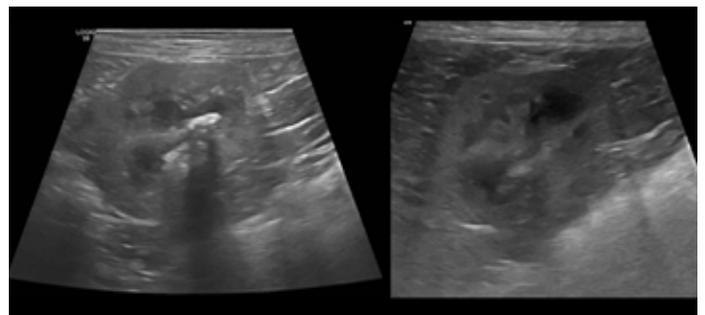


Image 6.B. Chronic kidney disease in a dog.

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cases; one exception is ethylene glycol intoxication, during which there is an increase in the echogenicity of the renal cortex. Chronic kidney disease can be associated with few ultrasonographic abnormalities (e.g., slightly increased echogenicity of the cortex) or important ones (e.g., smaller kidneys with irregular margins and loss of cortico-medullary definition) (Image 6.B. and C.)

Dilation of the pelvis caused by pyelonephritis or stones can be easily documented through ultrasonography and can be mono or bilateral. Tumors, blood clots, polyps, and stenosis of the ureters are rare.

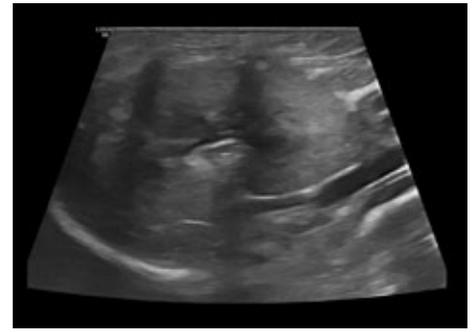


Image 6. C. Chronic kidney disease in a dog.

## BLADDER

Ultrasonography allows to examine the bladder in dogs if distended by urine easily. It is possible to evaluate its wall, sometimes ventrally thickened due to cystitis or the presence of stones, blood clots, and diverticula. Transitional cell carcinomas can be identified in the trigone, bladder neck, and proximal urethra. (Image 8.) As above for prostatic tumors, fine-needle aspiration of suspected transitional cell carcinoma of the bladder can also cause seeding.

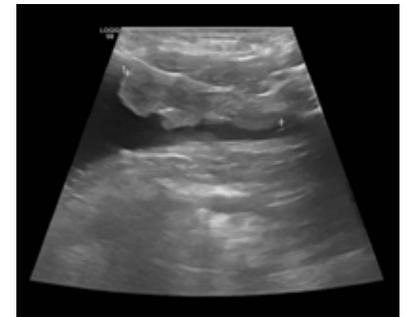


Image 8. Transitional cell carcinoma in a dog.

## PROSTATE

Ultrasonographic evaluation of the prostate is requested by Internal Medicine specialists in intact and older dogs with haematuria, dysuria, fecal tenesmus, or stiff gait (without orthopedic diseases). Rectal examination of the prostate may unveil pain, enlargement of the organ, or the presence of cystic lesions. Palpation, however, does not allow to characterize prostatic diseases; hence ultrasonography is recommended.

In the case of benign prostatic hyperplasia, there is an increase in organ size often associated with heterogeneous parenchyma. However, the presence of heterogeneous parenchyma is not specific and can also be found in prostatitis or prostatic neoplasia. Regarding the latter, it is important to note that both intact and castrated males can be affected. If acute prostatitis is present, tributary lymph nodes can be enlarged, while in chronic prostatitis and some prostatic tumors, intraparenchymal calcifications can be detected.

Other prostatic pathologies detectable with ultrasonography are cysts and abscesses. (Image 7.) Fine-needle aspiration can be performed, but seeding of neoplastic cells might occur with this procedure if a tumor is suspected.



Image 7. Prostatic abscess in a dog.

## OVARY & UTERUS

In intact female dogs, the ultrasonographic appearance of the ovaries varies during the oestrous cycle: in the anoestrus and initial proestrus, they are small, usually ovoid or bean-shaped. The development of follicles begins in the proestrus and reaches maturity in the oestrus. The most common pathologies that can be detected by ultrasound are ovarian cysts and tumors.

The most important uterine disorder, easily diagnosed with ultrasonography, is pyometra. It often develops in older dogs; clinical signs appear during dioestrus, including fever, vomiting, polyuria, and polydipsia. Ultrasonographic findings of the affected uterus include dilation by corpuscular fluid content and parietal changes compatible with endometrial cystic. (Image 9.) Other differential diagnoses in the case of a fluid-filled uterus are hematometra, mucometra, or hydrometra. Ultrasound can also be useful to diagnose and monitor pregnancy.

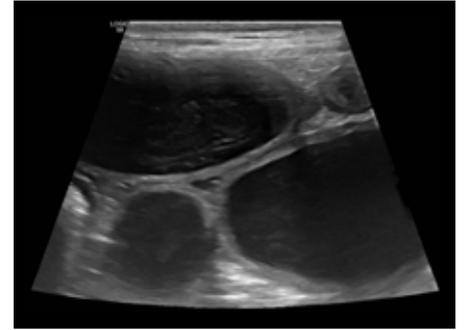


Image 9. Pyometra in a dog.

### CONCLUSIONS

The synergy between the Internal Medicine and the Diagnostic Imaging specialist allows veterinarians to complete the diagnostic workup in the large majority of dogs and, in turn, to provide treatment recommendations and monitor disease progression. Hence, ultrasound is an important instrument that should be present in the toolbox of all veterinarians. 🐾

*Images are kindly provided by AniCura Ospedale Veterinario I Portoni Rossi, Italy (Dr. S. Morabito and Dr. S. Specchi)*



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