

# Is that Intestinal Tract Normal? Ultrasound of the GI Tract

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## Normal gastrointestinal ultrasound

Ideally the patient should be fasted prior to ultrasonography to decrease the amount of gas and ingesta, particularly in the stomach. A complete exam of the abdomen is recommended to assess for concurrent disease such as mesenteric lymphadenopathy, pancreatic disease, carcinomatosis, etc. A high frequency transducer is important (> 10 MHz is ideal) to maximize resolution and completely evaluate wall layering.

Abdominal radiographs are complimentary to abdominal ultrasound and my preference particularly for patients with gastrointestinal disease is to obtain the radiographs first. Radiographs will help determine if there is abnormal distention of bowel and help evaluate the gastrointestinal content, which can be obscured by gas on ultrasound. Other additional important findings, such as pulmonary metastases or osseous lesions, may be detected with radiographs.

Complete ultrasonographic examination of the gastrointestinal tract includes evaluation of wall thickness (from inner mucosal margin to outer serosal margin) and layering, evaluation of luminal contents and determination of peristaltic function. The gastrointestinal tract should be scanned in multiple planes. For the stomach and duodenum this can be accomplished by scanning the cranial and right abdomen. For the small intestines it is best to examine the entire central abdomen in a zigzag pattern. The colon can be scanned based on anatomic location. The appearance of the gastrointestinal tract will vary greatly depending on the degree of distention and the luminal contents.

The stomach is rarely empty in the dog and often contains gas, even when fasted. When the stomach is empty it will look like a “flower” especially in the cat. In the normal dog the gastric wall is less than 5 mm in thickness and in the cat less than 3.5 mm. These thickness measurements are taken in between rugal folds. Gastric rugae can be recognized in the fundus and body of the stomach with the visibility and thickness dependent on the degree of gastric distension.

The normal thickness of the jejunum in dogs is less than 5 mm and in cats less than 2.5 mm. The duodenum tends to be the thickest area in dogs measuring up to 6 mm. In cats the ileum can measure up to 3.2 mm and has a prominent bright submucosa. The cat ileum has a distinctive “spoke-wheel” appearance. The large intestine is the thinnest part of the gastrointestinal tract and is usually less than 1.5 mm, but can be up to 3 mm in the dog and 2.5 mm in the cat if non-distended.

Ultrasonography allows for differentiation of the layers of the gastrointestinal tract, which alternate in echogenicity. Under optimal conditions, five separate layers can be identified. These include the luminal-mucosal interface (hyperechoic), mucosa (hypoechoic), submucosa (hyperechoic), muscularis (hypoechoic), and subserosa-serosa (hyperechoic). The submucosa and subserosa-serosa are hyperechoic because of the presence of relatively more fibrous connective tissue. The mean number of peristaltic contractions in the gastrointestinal tract is 4-5 per minute.

## Abnormal luminal findings

### Foreign bodies

Ultrasonography can be useful for the identification of a number of different types of gastrointestinal foreign bodies. The ability to detect objects depends on the location, gastrointestinal contents and distention, and the object composition.

One of the most common abnormalities of the gastrointestinal tract is distention. The two broad categories that should be distinguished are mechanical (obstructive) versus functional (paralytic) disease. Determining the degree and extent of dilation of the bowel will usually help with this distinction. Typically mechanical disease has a focal or segmental distribution, where functional disease is more diffuse. Mechanical obstructions usually cause bowel distention that is moderate to severe (this will be duration dependent) where functional disease usually causes mild to moderate distention. There are exceptions to these general rules. Dysautonomia often has a pattern more consistent with mechanical rather than functional disease. Very proximal duodenal obstructions may have very little distention if vomiting occurs. The identification of segmental bowel distension with fluid or gas may signify obstruction and should prompt a careful search for foreign material or mural disease that may be causing the obstruction. Because gas can surround foreign material these can be missed with ultrasound.

Objects that transmit sound are more accurately represented than are objects that attenuate sound. All but the near margin of strongly attenuating objects are obscured by the acoustic shadow that they produce. Although this shadow prevents full visualization of the object, its presence can be an indicator that foreign material is present. Objects that attenuate sound produce a highly echogenic linear interface at their near surface, followed by an acoustic shadow that may have either a “clean” or “dirty” appearance. The shape of the echogenic line may help to identify the type of foreign material present. Food/ingesta can shadow to various degrees and should not be mistaken for foreign material. Similarly feces within the colon can have a similar appearance to foreign material within

the small intestine. It is very important to recognize and distinguish large intestine from small intestine. The large intestine can often be traced cranially starting at the distal descending colon dorsal to the urinary bladder.

With ultrasound linear foreign objects are often associated with bowel wall thickening and plication. The foreign material is often hyperechoic with variable degrees of shadowing. Gastrointestinal parasites can sometimes mimic linear foreign material.

### **Intussusception**

The sonographic diagnosis of an intussusception is generally straightforward. An intussusception in the transverse plane is that of concentric layers of bowel wall within the intussuscepted segment (target or bulls eye). On the longitudinal scan an intussusception has the appearance of a thickened segment of bowel with an excessive number of layers that alternate in echogenicity. Hyperechoic mesenteric fat is generally seen associated within the intussusceptum.

### **Abnormal mucosal findings**

#### **Neoplasia**

Lymphosarcoma is the most common type of feline gastrointestinal neoplasm and occurs in the dog as well. The most common ultrasonographic features of lymphosarcoma are thickening of the stomach or bowel wall, loss of its normal layered appearance with reduced echogenicity of the wall, decreased motility, and lymphadenopathy. Diffuse disease can also occur with lymphoma.

Carcinomas are the most common gastric neoplasia in the dog. These usually originate in the pylorus, but may occur in any location in the stomach and also within the intestine. If the mass lesion is in the outflow region (pylorus) the stomach may appear severely distended with fluid, fluid and gas or empty post vomiting. Focal changes are often seen with carcinoma. Wall thickening is more often asymmetric, but it can be symmetric. The loss of the normal layered appearance of the gastrointestinal wall reflects infiltration of neoplastic and inflammatory cells, necrosis, edema, and hemorrhage. Carcinomas can have associated ulceration that is sometimes visible with ultrasound.

#### **Fungal disease**

Fungal diseases can cause both focal and diffuse lesions of the intestinal tract. Similar to neoplasia fungal disease can cause bowel wall thickening and loss of layering with a variable echogenicity.

#### **Inflammatory disease**

Inflammatory bowel disease has a broad spectrum of changes, which are relatively non-specific (animals with disease may have normal ultrasound examinations). Changes that have been reported are focal to diffuse thickening, altered echogenicity of the wall, poor intestinal wall layer definition and enlargement of adjacent lymph nodes. The most common small intestinal finding would be mild, diffuse wall thickening with intact wall layering. In comparison neoplasia is more often focal, with greater thickness of the wall and loss of the normal layering. These categories can overlap; therefore, cytology or histopathology is required for definitive diagnosis.

Lymphocytic-plasmacytic enteritis is highly variable in appearance. In cats increased thickness of the muscularis layer can be seen with chronic disease.

Gastritis can be diffuse or focal wall thickening and is often associated with decreased motility. Gastric wall edema is generally diffuse with thickening of the wall and altered appearance of the layering. Mineralization of the mucosa (hyperechoic, shadowing area) is seen occasionally with chronic uremia.

#### **Lymphangiectasia**

The ultrasound appearance of lymphangiectasia includes thin linear bands, oriented perpendicular to the lumen or an overall increase in echogenicity within the normally hypoechoic mucosa. These changes are thought to occur secondary to dilation of lacteals. Concurrent anechoic peritoneal effusion may be present.

#### **Miscellaneous**

Corrugation of the intestinal tract has been described with many disease processes. These include inflammation (enteritis, pancreatitis, focal peritonitis), neoplasia, and ischemia. Regional extension from pancreatitis often affects the stomach, duodenum, or colon.

#### **Methods of diagnosis**

When considering methods of diagnosis the two main considerations are the location and size of the lesion. With a mural lesion of the stomach or proximal duodenum, endoscopy is the preferred method of sampling. If the lesion is located in the small intestine or involves the entire stomach wall and is greater than 1cm in thickness then ultrasound guided fine needle aspirates can be obtained. For fine needle aspirates a 1 to 1 ½ inch 22-gauge needle should be used. If the lesion is thicker than the throw of the biopsy gun (usually 1 ½ to 2 ½ cm) a biopsy can be safely performed. It is important to avoid the lumen during aspiration and biopsy. Commonly, adjacent enlarged lymph nodes may be easier to sample than the affected bowel wall and if possible it is recommended that both areas be aspirated to increase the likelihood of an accurate diagnosis. Diffuse, mild wall thickening (especially if the thickened layer is the muscularis) is best diagnosed with full-thickness surgical biopsies.