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Abdominal Ultrasound

Mini Series

Session 3:

Gastrointestinal Tract & Pancreas

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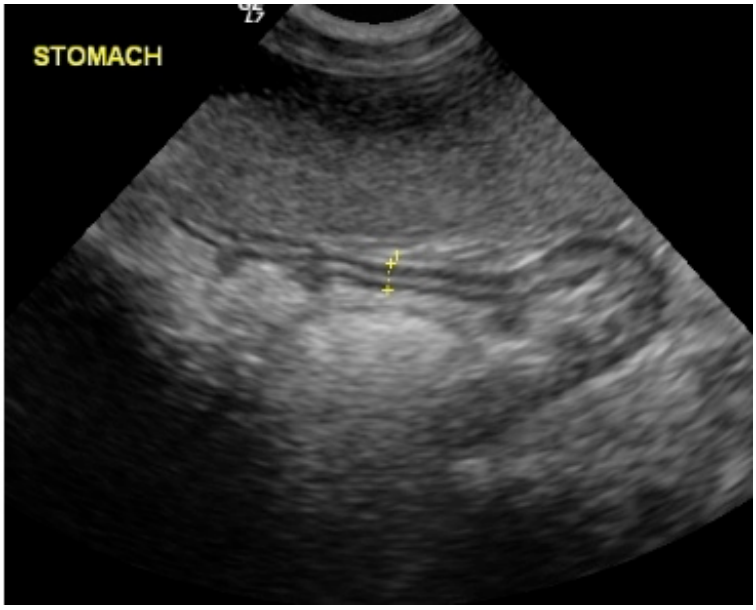


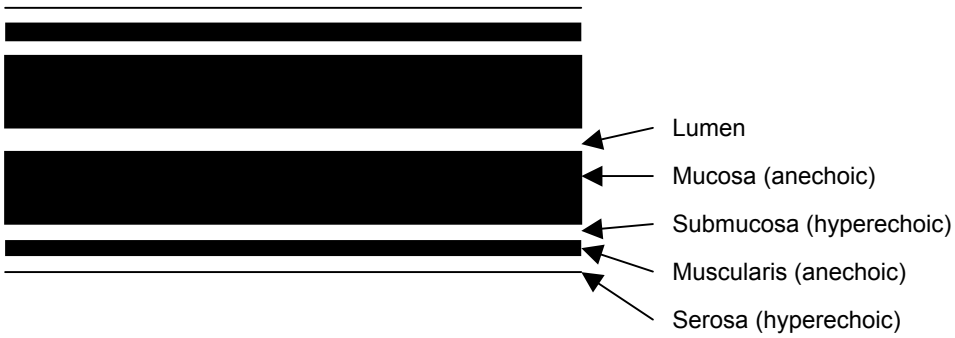
Abdominal Ultrasound Part 3 – GI tract and Pancreas

The Gastrointestinal Tract

Ultrasonography of the GI tract is an unwise procedure to undertake in isolation. It offers additional and complementary information to radiography, but is not a substitute, because of the limitations of gas within the lumen and also because, although certain specific parts of the gastrointestinal tract can be identified with ultrasound, it is rarely possible to thoroughly scan the whole of the small intestine with absolute certainty. Careful patient preparation is required; the patient should be fasted for at least 12 hours, but allowed free access to water. If the animal is stressed (e.g. hospitalised) or is suspected to have gastric outflow problems, then a 24 hour or even longer fast is advisable.

Normal Appearance

The walls of the entire GI tract have a distinctive layered appearance; these correspond to the histological layers as follows;



These layers vary in relative and absolute thickness depending on the region of the GI tract.

The stomach

The stomach is situated immediately caudal to the liver; it crosses the abdomen perpendicularly in the dog, and obliquely in the cat, so that often, the antrum is at the midline in the cat. If the animal

is conscious, then peristalsis may be observed, normally 3-4 times per minute; this is often reduced or absent in sedated or anaesthetised dogs. Rugal folds are easily seen and help to identify the stomach, but the stomach wall also has a characteristic layered appearance, which can vary slightly in thickness with distension, but in dogs the inter-rugal fold thickness is normally 3-5mm, and 2mm in cats.

Intestine

Often an acoustic window, e.g. the spleen can be used as a standoff to allow better evaluation of underlying bowel segments.

The duodenum runs superficially along the right side of the abdominal cavity, its normal wall thickness can be larger than that of the rest of the small intestine, up to 5mm thick in dogs. Occasionally, mucosal indentations can be seen along the antemesenteric border, consistent with Peyer's patches.

In dogs, the rest of the small intestine is usually considered to be normal thickness up to 4mm, and in cats, usually up to 2.5mm. The large bowel wall is much narrower and if filled with faeces, the wall can be hard to visualise at all without a very high frequency probe. The descending colon can be identified dorsal to the bladder (often indenting it), and then traced cranially. The ilio-caecocolic junction is frequently identified in cats, medial to the right kidney, but is often difficult to identify in dogs as the caecum is usually gas filled.

Abnormal Findings

In assessment of gastrointestinal disease, it is important to assess wall thickness, wall layering and wall symmetry, the distribution of the lesion and any extension of the lesion either locally, or to draining lymph nodes. With severe gastro-intestinal lesions, perigastrointestinal inflammation may be detected as a hyperechoic area in the mesenteric fat adjacent to the affected segment.

Ultrasonographic differentiation of inflammatory lesions from neoplasia is a complex subject, and while there are many indicators of each type of disease, there can always be exceptions and ultimately it is always wise to confirm suspicions with histology.

Inflammatory disease often results in no discernable ultrasonographic changes. Most commonly, there is mild wall thickening, but usually wall layering is preserved, and wall symmetry is

maintained. Occasionally wall thickening can be more severe and wall layering lost with severe inflammatory lesions, such as gastric ulcers. Neoplastic lesions tend to result in localised, marked wall thickening, which is usually asymmetric with disrupted wall layering. Adjacent lymphadenopathy may be present, especially with lymphoma. Carcinomas and leiomyomas also occur rarely.

If intestinal masses are large, it can be difficult to confirm their origin as intestinal, and it is important to note gas or fluid in the lumen of such masses, which is often eccentrically placed. It is also very useful to follow the affected segment to normal bowel, to further confirm its origin.

Intussusception

These are commonly seen in young dogs and often at the ilio-caecocolic junction. The appearance varies with the length of bowel involved, the duration and the orientation of the scan plane. The classically described sign is in the transverse plane, with a multilayered series of concentric rings representing the intussusceptum and the intussuscipiens. The intussuscipiens (outer bowel segment) is often oedematous and hypoechoic, the intussusceptum often appears as a normal layered bowel segment. The appearance may be confused by the presence of mesenteric fat also included with the intussusceptum. Intussusception may be associated with tumours and other bowel lesions and these may also confuse the appearance.

Foreign Bodies

These can be difficult to identify unless they have a characteristic shape (such as balls) or have caused complete obstruction and a large accumulation of bowel contents proximal to the obstruction. A bright interface associated with strong shadowing is highly suggestive of a foreign body. Bowel plication associated with linear foreign bodies can easily be recognised with ultrasound.

Pancreas

A 5-7.5MHz probe is required for examination of the pancreas in most dogs, in cats and small dogs

7.5- 10MHz is ideal.

The normal pancreas is usually localised by recognising the surrounding anatomy rather than direct visualisation. The pancreas is a V-shaped organ, consisting of a body and the left and right lobes. It is slightly hypoechoic to surrounding tissues and can be obscured if the gain is set too high. The pancreatic body lies ventral to the portal vein. The right limb lies dorsal or dorso-medial to the duodenum, it extends caudally to the level of the caecum. This limb is easiest to find in sagittal section; find the right kidney, and then reduce the pressure on the probe, but keeping the probe lateral and the duodenum should come into view. The right limb of pancreas will be deep to the duodenum; its margins may be seen more clearly in transverse section. The pancreaticoduodenal vein may be seen to course through the body of the pancreas, and with practice can be followed to the portal vein. With practice, the duodenum and right limb of pancreas can be followed to the pylorus and pancreatic body. The left limb of pancreas lies caudal to the greater curvature of the stomach and cranial to the transverse colon. The splenic vein lies caudodorsal to the left pancreatic limb.

Pancreatitis

Pancreatitis does not always produce severe enough changes to be detectable ultrasonographically, particularly early in the disease, especially in cats, so a normal ultrasound does not rule out pancreatitis, but often local transducer pressure causes pain. Pancreatitis can present a variety of ultrasonographic appearances; classically, the pancreas is enlarged and hypoechoic with surrounding hyperechoic fat. Occasionally the entire pancreatic region can be hyperechoic, with hazy shadowing. Cyst-like lesions and mixed patterns of echogenicity are commonly identified. An ill-defined hypoechoic mass with surrounding echogenic fat may also be seen. Pancreatitis cannot be distinguished from neoplasia on the basis of ultrasonographic appearance (but pancreatic neoplasia is comparatively rare). If correctly treated, pancreatitis tends to resolve on serial examinations, whereas pancreatic neoplasia does not. Variable amounts of free fluid may be present in the abdomen. Adjacent mild stomach or duodenal wall thickening may be identified; often the adjacent duodenum can have a corrugated appearance. Signs of biliary obstruction may also be present in acute pancreatitis if there is complete or partial obstruction of

the common bile duct.

Pancreatic pseudocysts commonly form in association with pancreatitis and these usually resolve over time. Occasionally they require surgical drainage. Pancreatic abscesses can also form, but are reported to be rare. Ultrasonographically they appear very similar to pseudocysts and even neoplasia. Differentiation in these cases is by serial ultrasound monitoring or surgical biopsy, depending on the clinical signs.

Pancreatic Neoplasia

Adenocarcinomas are the most common type, these are very aggressive and commonly metastasize before the onset of clinical signs. They tend to be seen as solitary or multifocal hypoechoic nodules or masses. If these are near the pancreatic body, then they can be associated with common bile duct obstruction. Insulinomas can also occur; these cases often show clinical signs (of hypoglycaemia) when the tumour is still very small, and hence these can be difficult to identify, and require patience and careful examination of the pancreatic region if suspected.

Congenital Cysts

In humans, these are seen in association with polycystic disease of the liver, kidney or ovary. Little is known about their causes in dogs and cats but they are seen occasionally. They tend to be round, thin walled and have anechoic contents.

Ultrasound Guided Sampling Techniques

These consist of fine needle aspiration and tissue core biopsies using automated biopsy instruments. A micro-convex probe is ideal for ultrasound guided sampling because it offers a good visualisation of the near field, but has a diverging beam, so needle placement is easier than with a linear probe. Specialised biopsy guidance equipment is available, but rarely used at least in veterinary medicine, and most biopsies are performed using the freehand technique. It is wise to

check the animal's clotting status prior to sampling any organ (history, clinical exam, biochemistry, haematology, clotting profile). This should be performed as close as possible to the time of the biopsy procedure. Known coagulopathies should be corrected first (or obtain a sample via another method). I usually perform aspirations and biopsies under general anaesthesia, to prevent laceration injuries if the animal moves during the procedure although heavy sedation can be sufficient for fine needle aspirates.

General considerations:-

- Choose the shortest distance and the safest path between the skin surface and the lesion to be sampled. Avoid vascular and other vital structures.
- The needle should not pass through more than one body cavity or abdominal organ.
- If sampling several sites, use a separate needle for each site.
- Prepare the site aseptically.

Technique

The transducer is held in one hand (usually the non-dominant hand) and the needle is held in the other. The needle is inserted close to the transducer and its entire path is seen as long as it is kept in the plane of the beam (this takes practice!) Ideally have the needle at 45 degrees to the path of the beam to optimise visualisation. All transducers have a marker to indicate the plane of the beam. Various phantoms can be constructed to practise this technique, e.g. jelly with fruit or tofu.

Fine needle aspirates are usually used for small lesions, cystic or vascular lesions or when a diffuse infiltrate with lymphoma or mast cell tumour is suspected. I usually use a 1.5 inch, 22g needle for these; occasionally, a longer spinal needle is necessary (remove the stylet). Techniques vary as to whether suction is used to obtain the sample. I attach a syringe to the needle and aspirate, some people find this unwieldy and just move the needle through the tissues several times to obtain a sample; the results obtained appear to be similar. Tissue core biopsies are preferred with large masses and other diffuse organ disease. I usually use a 9cm, 14g 'Tru-cut' needle, to get the largest possible sample. With either technique, it is important to deal with the sample quickly; spread FNA samples straight away, and insert Tru-cut samples into formalin as

soon as they are obtained.

Potential complications

Haemorrhage is the most common problem, but is usually minor and self limiting, as long as there are no clotting abnormalities. Doppler imaging before sampling can help to avoid vessels. Sepsis or peritonitis is possible if an abscess or infected lesion is sampled (abscesses with echogenic contents can appear surprisingly solid). Seeding of the tumour along the needle track is reported with transitional cell carcinomas of the bladder so catheter suction biopsy is advised for bladder masses.