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Imaging the Pancreas

The diagnosis of pancreatic disease can be challenging but has been improved in recent years with the introduction and advancement of various diagnostic tests. Identification of pancreatic inflammation has become common place in veterinary practice thanks in part to the use of amylase and lipase quantification, but more significantly with the introduction of the canine pancreatic lipase immunoreactivity (cPLI) test in dogs, and the feline pancreatic lipase immunoreactivity (fPLI) test in cats.

This article aims to discuss the various imaging modalities available both in general practice and at referral level for imaging the pancreas to complement the diagnostic tests that are now readily available.

Key words: Pancreas, Diagnostic Imaging, Radiography, Ultrasound, CT, Pancreatitis, Insulinoma

Imaging of the normal pancreas

The normal canine pancreas is not visible on survey **radiographs** due to its small size, relative similar opacity to the surrounding structures and location. For this reason, **ultrasound** has become the mainstay for imaging the pancreas in veterinary medicine due to its availability and relatively low cost compared with advanced imaging modalities.

1. Ultrasound of the pancreas is challenging and its reliability is inherently dependent on machine quality and operator skill and experience. In addition, the patient's conformation and body condition are hugely influential on the image quality of the pancreas. For instance, the pancreas of a lean Shih-Tzu will be much easier to find and interpret than the pancreas of an obese Boxer.

Pancreatic parenchyma has similar echogenicity to the surrounding mesentery and therefore knowledge of several landmarks for identification of the body and left and right limbs of this organ is essential (Fig. 1). The body of the

pancreas can be found caudal to the body of the stomach in the angle between the pyloric antrum and the ascending duodenum. The main portal vein can also be used as a landmark for the body, as it lies in close proximity to the ventral wall of the body of the pancreas.

The **right limb of the pancreas** is ventral to the right kidney and medial to the descending duodenum (Fig. 2). In barrel-chested dogs, the right limb can usually be traced from the body of the pancreas and with practice along the path of the descending duodenum from a ventrolateral approach. In deep-chested dogs, the right limb is easier to view from a lateral approach, again using the duodenum as a landmark. Viewing may require access via an intercostal approach. In cats, the right limb of the pancreas is smaller and therefore it can be slightly more difficult to identify. The left limb is more readily identifiable.

Landmarks for the **left limb of the pancreas** are the triad formed by the fundus of the stomach, transverse colon

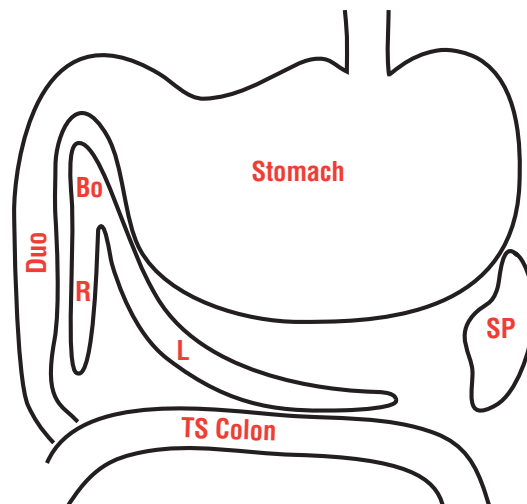


Figure 1: Schematic diagram of the **feline** pancreas from a ventral approach.

The left limb (L) of the pancreas is more prominent in cats and can often be visualised from a window on the left flank through the spleen (SP), positioned caudal to the greater curvature of the stomach and cranial to the transverse colon (TS colon).

The right limb (R) is squat in cats, but as in dogs roughly follows the path of the descending duodenum.

and spleen. More specifically, the left limb is closely associated with the splenic vein, which can be traced from the splenic hilus.

The normal pancreatic parenchyma has a similar echogenicity and echotexture to the surrounding mesentery, which is partly why it's such a tricky little structure to identify. An anechoic tubular structure is often identified running through the parenchyma. In dogs this will usually represent the pancreatic vein (Saunders, 1991), while in cats this is usually the pancreatic duct which measures a mean of 1.3mm (range 0.5-2.5mm) in cats older than 10 years of age (Hecht, Penninck, Mahony et al, 2006; Fig. 3). A summary of the ultrasonographic findings and differences between dogs and cats is contained within Table 1.

2. Computed Tomography (CT) is widely used in human medicine for imaging the pancreas, particularly in the acute abdomen patient. Documentation of acute versus necrotising pancreatitis is important in people with regards to managing decision-making, with the latter considered to represent a surgical emergency. In veterinary patients, the problems posed by obesity remain a problem but to a lesser extent than in human medicine. For this reason, CT of the pancreas is mainly reserved for those cases where response to medical management has been poor and a complicating factor is suspected (such as abscess, pseudocyst, necrosis or primary pancreatic neoplasia) or for the identification, surgical planning and metastatic staging of insulinomas or suspected exocrine pancreatic neoplasia.

CT allows for excellent visualisation of the body, right and left limbs of the pancreas. With the use of intravenous iodinated contrast agents, CT allows for evaluation of the vascularisation of the pancreas and multi-slice CT allows differentiation of the vascular phases (arterial, portal-venous and late venous); (Caceres, Zwingenberger, Hardam et al, 2006).

3. Magnetic Resonance Imaging: There is less documented use of magnetic resonance imaging (MRI) in veterinary medicine for pancreatic imaging. The normal appearance of the pancreas has been reported in cats (Newell, Graham Roberts et al, 2005; Marolf, Stewart, Dunphy et al 2011). The author has limited experience in the use of MRI of the pancreas and has personal preference for CT due to its reduced cost, speed of image acquisition and improved image quality over abdominal volumetric MRI sequences for multi-planar reconstruction.

Pancreatitis

Pancreatitis is now a well recognised disease entity in both dogs and cats. The diagnosis of pancreatitis can be suspected by a combination of clinical signs (vomiting, abdominal pain, diarrhoea, inappetance) and elevated amylase and lipase. A positive cPLI or fPLI is highly sensitive for the detection of pancreatic inflammation; however the specificity of these tests is somewhat lower as in addition to pancreatitis, pancreatic inflammation will also be seen in pancreatic adenocarcinomas, abscesses and secondary to inflammation of local organs, especially the stomach and duodenum (Watson, 2004).

1. Radiography

Radiography has a poor diagnostic accuracy in pancreatitis (Shanaman, Schwarz, Gal, 2013). The pancreas in healthy dogs is not visible on plain abdominal radiographs; the left limb occasionally is seen in healthy obese cats. Unless the pancreatic

“Ultrasound should be considered the imaging test of choice in cats and dogs with suspected pancreatic inflammation”

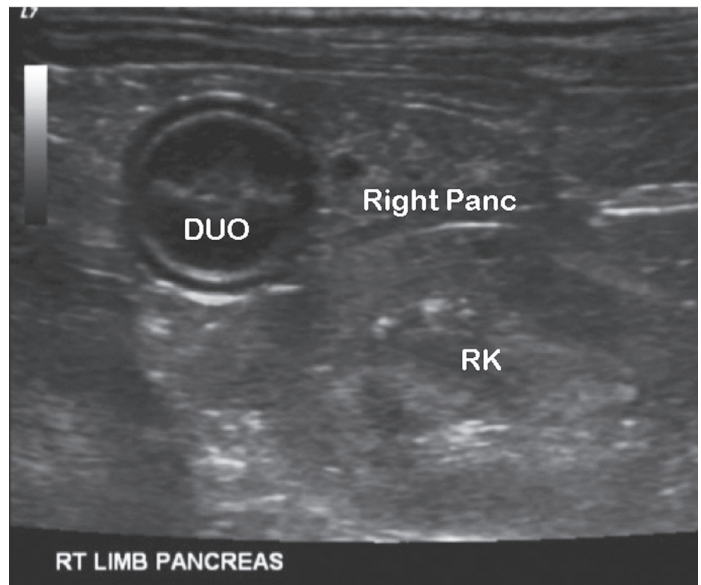


Figure 2: Transverse ultrasound image of the right limb of the pancreas in a dog. The duodenum (DUO) is shown in transverse adjacent to the triangular normal right limb of the pancreas (Right Panc). Note the similar echogenicity of the pancreatic parenchyma to surrounding mesentery. The right kidney (RK) is present in the far image.

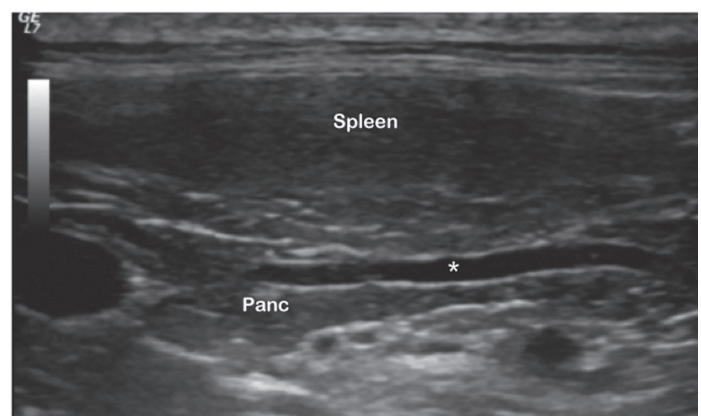


Figure 3: Ultrasound image of the left limb of the pancreas of a cat. Note the pancreatic duct running through the centre of the pancreas (*), a normal finding in cats.

	Dog	Cat
Lobe easiest to identify	Right	Left
Landmarks	Duodenum (R) Stomach, spleen, colon (L)	Portal and splenic veins
Thickness	~1cm	0.5-0.9cm (body/left) 0.3-0.6 (right limb)
Connection to duodenum	Minor duodenal papilla	Major duodenal papilla with CBD
Pancreatic duct	Not usually seen	0.5-2.5mm through centre of pancreas
Blood vessels	Usually identified	Usually not visible

Table 1: Comparison of the differences in ultrasonographic imaging of the pancreas in dogs and cats.