Is that the pancreas I see before me?

Imaging of the pancreas
Sarah Tibbs, BVetMed, DACVR
Dogs and Cats Veterinary Hospital
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Thank you

Oh and the mysterious organ itself…..
Outline

● Anatomy
  o gross

● Imaging
  o radiographic
  o ultrasonographic

● Other imaging modalities are available
  o MRI
  o Cholangiopancreatography
  o Scintigraphy
  o Endoscopic ultrasound
  o Contrast enhanced ultrasound

Examples

  o pancreatitis dog/cat
  o pancreatic cyst/abscess
  o benign pancreatic changes
  o pancreatic cancer
    - carcinoma/carcinomatosis

Sampling

What is the Pancreas?

● Glandular tissue (dual function)
  o exocrine - digestive enzymes (the majority of the tissue)
    ▪ digest protein, carbohydrates and fats
  o endocrine - insulin, glucagon, gastrin
    ▪ carbohydrate metabolism
Gross Anatomy (described for dog)

- 2 lobes: right (4 inches) and left (6 inches), connected by a $45^\circ$ body
- Develops from 2 buds that merge
- Drains to regional lymph nodes that include: duodenal, hepatic, splenic and mesenteric

Blood supply

- Arterial supply both cranially and caudally: pancreaticoduodenal arteries
  - cranial branch from celiac
  - caudal branch from cranial mesenteric
- Venous drainage to the portal vein
  - pancreaticoduodenal vein (caudal right)
  - gastroduodenal vein (cranial right)-last into the PV
  - pancreatic veins (2, left side)-go to splenic vein

Why do I care the pancreas’s vessels

1) Anatomic landmark (more so in the dog)
2) To identify vessel or duct
   - diseases may alter these structures
   - duct dilation with pancreatitis
   - vascular disruption or alterations from neoplasia
3) The veins of the pancreas are critical when evaluation of portal vein anatomy
   - the gastroduodenal vein is the last vessel in to the portal vein before it enters the liver

Example of dog normal vessels

![Image of normal dog vessels with labeled structures: Pancreas, Duodenum, gastroduodenal v, PV]
The duct(s)

- The internal ductal system anastomoses and is variable between individuals
- Dogs - often 2 ducts
  - accessory pancreatic duct (→ minor duodenal papilla) and despite these names it is the main player
  - pancreatic duct (→ major duodenal papilla with the bile duct) sometimes absent

Cats are NOT little dogs

- There pancreas is larger on the LEFT side
- The angle of the body is sharper
- Usually 1 pancreatic duct
- It joins with the bile duct in a T intersection and then both enter the major duodenal papilla
1) An anatomic landmark (more so in cats)
2) Sometimes they get big with pancreatitis
3) They can have stuff in them/obstruction
   pancreoliths
4) Cats with bile duct issue can also have
   pancreatic duct issues

Example of ducts with stones
So what is the best way to see the pancreas

It is considered difficult to image by most modalities
- US is considered the best
- Radiographs pancreatic disease is inferred (but useful in overall work up)
- CT you can see the pancreas anatomy in an axial plane

CT
- Frequently used when evaluating for insulinoma/pancreatic neoplasia
- Generally a dual phase contrast study is performed
- CT has been unreliable for pancreatitis diagnosis in dogs and cats
Other more pedantic modalities

- Are not standardized and variable results
- Cost, availability and anesthesia - ugh
- Mostly done in humans
- Pilot or feasibility studies in animals
  - Endoscopic ultrasound
  - Endoscopic retrograde cholangiopancreatography
  - MRI and MR cholangiopancreatography - cats promising
  - Contrast enhanced ultrasound

Oh yah, scintigraphy - apparently you can label some somatostatin like stuff, with a radioactive substance - it will go to islet cells and there are lots of these insulinomas.

Endoscopic ultrasonography

- because pancreas near stomach, duodenum and trans colon - gas can obscure
- the ultrasound is placed directly into the GI tract - this allows an unobstructed view with subero detail and no gas interference

Endoscopic retrograde cholangiopancreatography

- Use endoscopic to guide catheterization of the duodenal papilla(e)
- then retrograde fill the ducts
- visualize gallbladder, bile duct and pancreatic ducts with fluoroscopy
- tested in dogs and cats - feasible
- looking for “obstructions”
- interventional procedures - stents, remove stones


MR cholangiopancreatography

- non invasive, not operator dependent
- map bile duct and pancreatic duct
  - no radiation
  - no contrast administration - use natural fluid T2 brightness
- get to image entire abdomen

Radiographic anatomy

- The pancreas is not typically seen in dogs
- The left limb of the pancreas can be seen in cats with sufficient abdominal fat
- Pancreatic findings are typically inferred
- Anatomy of the position of the pancreas is important

Radiographic anatomy DOG

- Right pancreatic lobe:
  - From 9-10th ICS to L4
  - Ventral to the duodenum
  - The kidney is dorsal
- Left pancreatic lobe:
  - Distal aspect close to the left kidney
  - Caudodorsal to the stomach
  - Craniodorsal to the transverse colon
Rad anatomy: DOG

- On the VD view - right cranial abdomen
  - the cranial duodenal flexure main anatomic landmark

Cats are still not little dogs
Radiographic signs with pancreatic disease

- Often normal
- No changes are specific
- Changes in the region of the pancreas
  - Mass
  - Loss of detail
    - right cranial abdomen
    - dogs: “ground glass” in mid-abdomen
    - cats loss of detail around the left limb of pancreas

Rad signs cont

- Changes in gas pattern in proximal GIT
  - Gas in the duodenum
  - Increased width of the cranial duodenal flexure
- Changes in the GIT adjacent to the pancreas: stomach or duodenum
  - position
  - shape
Pancreatic mass

Pancreatitis
Pancreatitis

Ultrasound of the pancreas

- Considered the imaging method of choice for diagnosis of pancreatitis
- Available, no anesthesia needed
- Sometimes hard to see pancreas because of the GIT
- Normal appearance does not rule out disease
Ultrasonographic technique

- Any body position
- High frequency probes best (8-12 MHz)
- Anatomic landmarks are critical for identification
- Earlier publications listed a 50% ID rate
- NOW: “improvements in technology provides better visualization that was possible a few years ago”

US anatomy - Dog - Right limb

4-10mm, 1 mm duct
- Medial dorsal to the duodenum
- Ventral to the kidney

Technique -
- Locate duodenum
- Turn 90 degrees
- Look for triangular pancreas and vessel in the middle
Right limb dog

Right US anatomy - Dog- Left

Shorter and harder to see
Find in the sagittal plane

Splenic vein is caudal dorsal

in between stomach, spleen, left kidney, with the portal vein medially
US anatomy - Cats - Left

- 5-9 mm, with less than 2.5 mm duct
- Left limb easier
- See the duct clearly
  - caudal to stomach
  - cranial to colon
  - medial to spleen

In a triangular zone of fat/mesentery between these structures

described as iso to hypoechoic to fat

Ultrasound anatomy - Cat - Right

- Harder to see
- Smaller at 3-6 mm
- Medial dorsal to the duodenum
- Can use the PV in transverse plane to find the body of the pancreas
Pancreatitis changes on US

- nothing (especially a problem in cats)
- hyperechoic/attenuating surrounding tissue
- peritoneal effusion (focal peritonitis)
- hypoechoic, enlarged, irregular pancreas

Also:
- pancreatic duct dilation
- EHBO
- cysts/abscesses

Some pancreatitis examples
Pancreatitis Dog

Pancreatic body

Enlarged and irregular surrounded by hypoechoic tissue

Severe gastric wall thickening

Thickened duodenum

Hypoechoic

Bright cranial normal caudal mesentery along the right side of the abdomen
complex fluid filled lesion
very hypoechoic residual cavitated lesion from abscess

initial study
severe adjacent stomach wall thickening
enlarged and irregular

1 week later, still pancreatitis and now suspect abscess

Post operative
very hypoechoic still pancreatitis

Initial study images
irregular hyperechoic margin, central fluid filled lesion

1 week later pancreas still inflammed

1 week later

hypoechoic irregular pancreas

3 weeks later

1 month later
7 months later

Pancreatitis - good clinical response to treatment
Recheck US - persistent hyperechoic pancreatic/peripancreatic changes

veins this mottled appearance - possible previous or chronic disease

Pancreatitis cat

severe

less severe

chronic
Benign pancreas changes

Pancreatic edema
anechoic tissue interleaved between the lobules of the pancreas

Nodular hyperplasia

Normal pancreas surrounded by ascites—this often increased pancreatic conspicuity
Pancreatic cancer/carcinomatosis

• OK, so now you see the pancreas, should you sample it?!
  - old adage was sampling was risky - as it may induce pancreatitis
  - a study has been done that has shown sampling to be safe
  - cytology and even histology however have been shown to be unreliable

Do you see it now?
References

- Nyland and Matton. Veterinary Diagnostic Ultrasound.
- Journal of small animal practice 2015; 56. All of the articles in this volume are pancreas related - which are open access for anyone.