IMAGING THE CANINE PANCREAS
Thomas Spillmann, Dipl. vet. med., Dr. med. vet.
Professor of Small Animal Internal Medicine
Department of Equine and Small Animal Medicine
Faculty of Veterinary Medicine
University of Helsinki, Finland
PO 57 (Viikintie 49)
00014 Helsinki University / Finland

Introduction

Imaging techniques for the diagnosis of pancreatic diseases have following four aims (1):
- To diagnose a pancreatic disease
- To assess its spatial extension
- To reveal differential diagnosis and etiology of the disease
- To assess indication and viability of surgical interventions

Imaging techniques that have been used in humans and also animals are regarding their invasiveness: plain and contrast radiography, abdominal ultrasound, contrast enhanced computed tomography, endosonography, endoscopic retrograde pancreatography and laparoscopy with pancreatic biopsy. Radiography has proven to be the least sensitive and specific technique to diagnose pancreatic diseases. Therefore the following review will not cover X-ray but the diagnostic advantages and limitations of all the other mentioned techniques.

Abdominal ultrasound

The advantage of abdominal ultrasound is the low invasiveness, relatively easy accessibility in veterinary practice, and good visualization of the normal and diseased canine pancreas when high quality equipment is used by an experienced ultrasonographer (2). Combined with fine needle aspiration for cytology, ultrasound can contribute to the diagnosis of inflammation (necrosis), pseudocyst or tumor (3). A special advantage is the possibility of arbitrary repetition of the ultrasonographic examination (1).

Limitations are caused by the close association of the pancreas with the stomach and duodenum. Intragastric and intraduodenal gas can disturb or even prevent the imaging of the whole pancreas. Other negatively influencing factors are abdominal pain, difficulties in sonographic differentiation between necrosis and tumor or acute and chronic pancreatitis (2). Therefore abdominal ultrasound has to be seen as a basic imaging technique in the diagnostic work up of pancreatic diseases. It's limitations in assessing the full extend of morphologic changes, in differentiating pancreatic necrosis or chronic pancreatitis from pancreatic carcinoma and in taking tissue samples indicates the necessity to use more advanced imaging techniques. A future improvement is expected by the introduction of contrast enhanced ultrasound (CEUS) into veterinary medicine. This technique allows a better differentiation between inflammation and neoplasia and to assess the extent of morphological changes (4).
Computed tomography

Contrast enhanced computed tomography (CT) has become a corner stone in the diagnosis of pancreatic diseases in people. It is used to differentiate acute from chronic pancreatitis, to assess severity and extent of inflammatory and neoplastic processes and for planning the surgical approach when indicated. CT has also been used successfully in dogs to describe the appearance of the normal pancreas and to diagnose acute and chronic pancreatic diseases with high accuracy (5 - 9).

However, due to difficulties in accessibility, necessity for anesthesia and contrast application as well as high examination costs, CT has not yet achieved the same significance in veterinary gastroenterology as it has for people.

Endosonography

Endosonography of the pancreas is performed with equipment that combines flexible endoscopy with ultrasound. Main indication for endosonography in people is the search for very small tumors and metastasis in liver and pancreas that can not be visualized by abdominal ultrasound or CT. Due to high sensitivity and the possibility for exact sampling of biopsies out of sonographically abnormal areas endosonography helps to assess the actual size and localization of tumors and to assess the necessary extent of a surgical intervention (10).

A drawback for veterinary medicine is the high costs of the equipment. The technique has been used in dogs for a limited number of studies that proved its usefulness for imaging the normal and diseases pancreas (11-13).

Endoscopic retrograde pancreatography

Endoscopic retrograde pancreatography (ERP) is an imaging technique that combines endoscopy and fluoroscopy. It has been used for decades in people for diagnosing and staging chronic pancreatitis and pancreatic carcinoma by assessing contrast images of the pancreatic duct system and by taking brush cytology samples (14).

Current attempts to introduce this imaging technique also into veterinary medicine revealed in healthy dogs that ERP is technically possible and easier to perform than endoscopic retrograde cholangiography. It was possible to establish reference images and values for the length of both parts of the accessory pancreatic duct for healthy beagles (15). Using ERP in dogs with chronic gastrointestinal problems, the procedure was successful in 21 of 30 cases (70% success rate). It revealed abnormal findings of pancreatic ducts in 2 dogs with proven pancreatic acinar atrophy but showed normal images in the other patients (16). The low prevalence of abnormal duct findings can be explained by the fact that the patients for the procedure were not specifically selected for the suspicion of a pancreatic disease. ERP did not cause any
mild or severe side effects such as acute pancreatitis neither in healthy dogs nor in dogs with chronic gastrointestinal problems (15, 17).

The use of this promising technique is limited by the size of available duodenoscopes with a 90 degree side view optic. Duodenoscopes used in adult people have a tip diameter of 11-13 mm and can not be used in patients of < 10 kg. Pediatric endoscopes could be used but unfortunately they are currently very expensive.

**Laparoscopy**

Laparoscopy has been used for minimal invasive direct imaging of the canine pancreas and the withdrawal of tissue biopsies for histology. It was shown that it is an excellent tool to diagnose and differentiate pancreatic diseases such as chronic pancreatitis, pancreatic adhesions to adjacent organs, and partial pancreatic acinar atrophy. Side effects are minimal and pancreatic biopsy has not been reported to cause severe or even lethal complications. Therefore this technique is highly recommended especially to diagnose chronic pancreatitis (18 - 23).

The only disadvantage is the relative high initial investment for the necessary equipment. The positive experience with diagnostic laparoscopy also for hepatic diseases has made this technique to a valuable diagnostic for the veterinary gastroenterologist (20, 21).

**References**

6. Rüst, S: Computertomographic imaging of the pancreas in dogs. Doctoral thesis (German). Faculty of Veterinary Medicine, Justus-Liebig-University, Giessen, Germany, 2001
tomographic angiography of the normal canine pancreas. Vet Radiol
10. Gaschen L, Kircher P, Lang J. Endoscopic ultrasound instrumentation,
applications in humans, and potential veterinary applications. Vet
11. Lecoindre P. Endosonography of the pancreas and the biliary tract.
Abstract, WSAVA congress, Berlin,1993
12. Morita Y, Takiguchi M, Yasuda J, Kitamura T, Syakalima M, Eom K,
Hashimoto A. Endoscopic ultrasonography of the pancreas in the dog.
ultrasonographic findings and grey-scale histogram analysis in dogs
14. Cotton PB, Williams CB. Endoscopic retrograde cholangio-
pancreatography. In: Cotton PB, Williams CB (eds): Practical
105–186.
15. Spillmann T, Happonen I, Kahkonen T, Fyhr T, Westermarck E.
Endoscopic retrograde cholangiopancreatography in healthy beagles.
TCW, Rüst SK. Endoscopic retrograde cholangiopancreatography in
dogs with chronic gastrointestinal problems. Radiol Ultrasound 2005;
46:293-99
17. Spillmann T, Happonen I, Sankari S, Kahkonen T, Westermarck E.
Evaluation of serum values of pancreatic enzymes after endoscopic
18. Geyer S. Laparoscopic visualisation of the canine pancreas (German).
19. Geyer S, Schäfer EH. Contributions to laparoscopy and biopsy of the
canine pancreas (German). Tierärztl Prax 1979; 7: 367-77
20. Magne ML. Laparoscopy: Instrumentation and technique. In: Tams TR.
21. Tweedt DC Diagnostic laparoscopy. Proceedings of the 19th ACVIM
22. Spillmann T, Moritz A, Burkhardt E. Diagnostic value of laparoscopy for
pancreatic diseases in dogs. (German). Tierärztl Prax 2000; 28(K):
349-55
23. Harmoinen J, Saari S, Rinkinen M, Westermark E. Evaluation of
pancreatic forceps biopsy by laparoscopy in healthy dogs. Vet
Therapeut 2002; 3: 31-6