GETTING JUICED ABOUT PANCREATIC DISEASE

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AVIAN PANCREAS

In most avian species, the pancreas is trilobed with the third, or splenic, lobe sometimes being detached from the other two. The duodenal loop encircles most of the avian pancreas. In most species, each lobe has a separate draining duct. In general, the ducts all drain into the duodenum often at the distal duodenal loop.

The functions of the pancreas can be divided into exocrine and endocrine. The avian exocrine pancreatic enzymes such as amylase, carboxypeptidases, deoxyribonucleases, elastases, ribonucleases, trypsin, chymotrypsin and lipases are similar to those found in mammals. Also of note, the intestinal wall mucosa can produce amylase, lipases and other enzymes that aid in digestion. Amylase levels are highest in the jejunum of birds.

The primary endocrine function of the pancreas is glucose metabolism. Following feeding, plasma glucose and amino acids stimulate the release of insulin from pancreatic B cells. The insulin aids the liver in glycogenesis. With low blood glucose concentration, glucagon (pancreatic A cells) increases and insulin decreases. Elevated glucagon (catabolic) stimulates glycogenolysis, gluconeogenesis, and lipolysis in the liver. Somatostatin (pancreatic D cells) controls the ratio of insulin to glucagon released from the pancreas. Pancreatic peptides (F cells) are stimulated by cholecystokinin, secretin, absorbed amino acids and gastrin and are glycogenolytic without producing hyperglycemia. The interactions of the endocrine pancreatic components with other body systems and diabetes mellitus are very complex and will not be further covered here.

PANCREATITIS

When digestive enzymes such as protease, phospholipidase, and trypsin are activated within the pancreas, pancreatitis can result. Subsequent damage results in further release and activation of these enzymes into ducts and extracellular tissue. Resultant free radical production can produce further damage.

The actual initiating cause of pancreatitis is sometimes difficult to identify; however, several factors have been noted. Viral diseases including Paramyxovirus type 3 (especially in Neophema spp), adenovirus, herpesvirus, polyomavirus and avian influenza A can all cause variable pancreatic inflammation and necrosis. Bacterial invasion (presumably through the intestinal tract or systemically) can also cause pancreatitis. Obesity-related pancreatitis, especially those psittacine species on all-seed diets, is commonly discussed. Some species such as quaker parakeets (Myiopsitta monachus) are especially prone to acute pancreatic necrosis and death. The author has also observed this syndrome in macaws (Ara spp). Zinc toxicosis results in pancreatic vacuolization and acinar cell degeneration. Secondary damage from egg yolk peritonitis (coelomitis) may also cause pancreatitis. Birds with exocrine pancreatic insufficiency often have pale voluminous feces and may exhibit chronic weight loss. Primary and metastatic pancreatic cancer may also be encountered.

DIAGNOSING PANCREATIC DISEASE

As with mammals, diagnosing pancreatitis in birds can be difficult. Gastrointestinal dysfunction (vomiting, diarrhea, ileus, polyuria, polydipsia, and coelomic distension) and pain (anorexia, lethargy, aggression, wide-based stance, kicking, coelomic feather damaging and obsessive chewing) are some of the nonspecific signs associated with pancreatitis. Blood amylase is probably the best noninvasive method used to diagnose pancreatitis. However, blood amylase may also increase with proventricular, ventricular and small intestinal disease, renal disease, glucocorticoid administration and coelomic inflammation and is therefore not specific to pancreatic disease. Pancreatic biopsy is the method of choice for diagnosing pancreatic diseases.

TREATING PANCREATIC DISEASE

Strategies for treating pancreatic diseases have been adapted from the mammalian literature. Immediate care often consists of fluid therapy to correct fluid deficits and promote tissue perfusion, analgesics (butorphanol), intestinal motility stimulants (metaclopramide and cisapride) to counteract intestinal ileus and parenteral antibiotic therapy. Zinc and other toxicoses should also be treated. Omega-3 fatty acids may also be used for their anti-inflammatory and lipid stabilizing effects. Converting birds on an all seed diet to a lower fat diet is also appropriate. Plasma transfusions may help by replacing protease inhibitors and slowing or stopping further pancreatic damage in cases of life threatening pancreatitis. Contributing gastrointestinal foreign bodies should be addressed ideally with conservative means or surgical removal if needed. Pancreatic enzymes can be added to food to ‘pre-digest’ a meal for birds with exocrine pancreatic insufficiency. Surgical debulking and chemotherapy may be considered in cases of pancreatic neoplasia.

PANCREATIC BIOPSY AND DUODENAL ASPIRATION

Pancreatic biopsy is indicated when pancreatic disease, such as pancreatitis and neoplasia, is suspected and accurate diagnosis is needed for individual case management. A cranial ventral midline approach is used similar as with liver biopsy. The dorsal and ventral pancreatic lobes rest between the ascending and descending duodenal loop. The duodenum is located to the right of midline and is often covered by a thin peritoneal membrane. Incise through the thin membrane and gently retract the duodenal loop. After examining the pancreas and duodenum for gross
abnormalities, select the distal (free) end of the dorsal pancreatic lobe (unless another site is clearly abnormal). Using hemostats, clamp the pancreas just distal to its distal-most vessel coming off the duodenum. Remove the distal pancreatic fragment and submit for pathologic evaluation. Usually, a 3- to 8-mm section of pancreas is harvested. Remove the hemostats, but re-apply if bleeding occurs. Sutures to control hemostasis are rarely indicated. Close the abdomen in standard fashion.

Pancreatic duct ligation results in severe damage to the pancreas. Most of the pancreas lies within the duodenal loop and has one to three draining ducts that enter the terminal duodenum in close proximity to the bile and hepatic ducts. The potential complications of bile duct ligation are listed below. Pancreatic duct ligation results in atrophic pancreatic acini and interstitial fibrosis in chicks (similar to what is noted with the same procedure in mammals). Pancreatic duct obstruction has been a proposed cause of stunting syndrome in chickens.

If both bile ducts are ligated (chickens), severe fibrosing cholehepatitis results within 28 days. The typical lesions that result from extrahepatic bile duct ligation in poultry include cholestasis, fibrosis, proliferated biliary ductules and increased Ito (fat storing) cells within the liver. While not jaundiced, chickens with both bile ducts ligated also developed intensely yellow stained droppings 6 to 7 days post surgery. Bile duct ligation results in atrophic and sclerotic testes 10 weeks post surgery in 1-year-old chickens likely as a result of the hepatic fibrosis and obstructive cholestasis the procedure causes.

A high-grade pancreatic exocrine adenocarcinoma was removed from a 5-year-old male cockatiel via celiotomy. The report describes a “large, firm, white multinodular pedunculated mass (2.5 cm in diameter) that originated between the distal portion of the pancreas and ascending loop of the duodenum.” The authors also reported they removed the distal tip of the pancreas adjacent to the mass at the same time. Neoplastic cells were surgically evident at the biopsy margins. Six weeks after surgery, the bird was doing well and celecoxib (10 mg/kg PO SID) was administered for 3 months. One hundred forty-two days post surgery the bird presented with dyspnea and died during diagnostic sample collection. The bird had diffuse metastatic pancreatic adenocarcinoma. Of note, the bird had acute diffuse renal tubular necrosis (possibly due to the celecoxib).

The birds and their pancreas seem to tolerate pancreatic surgery well. Following 99% pancreatectomy in chickens, the splenic pancreatic lobe undergoes a rapid enlargement (400% increase) over 16 days. Partially depancreatized chickens, with splenic lobe intact, also seem to maintain metabolic parameters remarkably well although a post-surgical transitory hyperglycemia may be noted. One conclusion drawn is that the avian splenic lobe appears to be “extremely competent following removal of the major avian pancreatic lobes in adjusting to the demands placed on it for adequate nutrient absorption and distribution.” Total pancreatectomy is fatal, but subtotal pancreatectomy (leaving the splenic lobe intact) results in transient “diabetes” that resolves in 12 days in Peking ducks.

Duodenal aspiration may be helpful in identifying occult parasitic (Giardia spp and other protozoa) and Mycobacteria spp infections and small intestinal bacterial overgrowth. Via a ventral midline surgical approach, the duodenal loop is isolated (see above). Using a 25-gauge or smaller needle, aspirate the duodenal contents for culture and cytology. Additionally, use another needle with the bevel side up to aspirate the mucosal surface of the duodenum. Oftentimes, occult mycobacterial organisms can be recovered cytologically by aspirating affected thickened duodenal mucosa. Closure is standard and the collected samples should be processed/evaluated as soon as possible.

REFERENCES: