THE NORMAL PANCREAS AND WHAT IT DOES

We eat food, chew it up into a slurry, and swallow it. It travels down the esophagus to the stomach where it is ground up further and enzymes are added to begin the break-down of dietary nutrients ("digestion"). When the food particles are small enough, they are propelled into the small intestine for further digestive treatment and ultimately nutrient absorption.

The small intestine has three portions: the duodenum which connects to the stomach and the jejunum and ileum below. The jejunum and ileum are mostly involved in absorption but the duodenum, being so close to the stomach, is the site of further digestion.

There are two ducts that enter the duodenum near where the stomach contents enter. One duct is for bile, squirted in directly from the liver’s gall bladder. The bile serves to neutralize the acid which the stomach had added, to emulsify (or dissolve) dietary fats for absorption later in the tract, and also to excrete some toxins. The other duct is the pancreatic duct which squirts in more digestive enzymes so as to break down starches and continue the break down of protein.

The pancreas is a pale pink glandular organ that nestles cozily just under the stomach and along the duodenum. As a glandular organ, the pancreas is all about secretion and it has two main jobs: the first job is the secretion of digestive enzymes to help us break down the food we eat, the second job is the secretion of insulin and glucagon (to regulate sugar metabolism). The digestive enzymes are the part of the story that concerns us in pancreatitis.

PANCREATITIS IS INFLAMMATION OF THE PANCREAS

In pancreatitis, inflammation disrupts the normal integrity of the pancreas. Digestive enzymes which are normally safely stored in granules are released prematurely where they digest the body itself. The result can be a metabolic catastrophe. The living tissue becomes further inflamed and the tissue damage quickly involves the adjacent liver. Toxins released from this orgy of tissue destruction are released into the circulation and can cause a body-wide inflammatory response. If the pancreas is affected so as to disrupt its ability to produce insulin, diabetes mellitus can result; this can be either temporary or permanent.

SPECIAL PANCREATITIS DISASTERS

- Special disasters include the disruption of “surfactants” in the lung tissue which normally keep the tiny air-filled alveoli from collapsing after each exhaled breath. Without surfactants, the alveoli close up and respiratory failure results.
- Also, there is a special syndrome called “Weber-Christian syndrome” where fats throughout the body are destroyed with painful and disastrous results.
- Pancreatitis is one of the chief risk factors for the development of what is called “disseminated intravascular coagulation” or “DIC” which is basically a massive uncoupling of normal blood clotting and clot dissolving mechanisms. This leads to abnormal simultaneous bleeding and clotting of blood throughout the body.
- Pancreatic encephalopathy (brain damage) can occur if the fats protecting the central nervous system become digested.
The good news is that most commonly the inflammation is confined to the area of the liver and pancreas but even with this limitation pancreatitis can be painful and life-threatening. Pancreatitis can be acute or chronic, mild or severe.

WHAT CAUSES PANCREATITIS

In most cases we never find out but we do know some events which can cause pancreatitis:

• Backwash (reflux) of duodenal contents up into the pancreatic duct. The pancreas has numerous safety mechanisms to prevent self-digestion. One of these mechanisms is the fact that the enzymes it creates are stored in an inactive form. They are harmless until they are mixed with activating enzymes. The strongest activating enzymes are made by duodenal cells which means that the digestive enzymes do not actually activate until they are out of the pancreas and mixing with food in the duodenum. If duodenal fluids backwash up the pancreatic duct and into the pancreas, enzymes are prematurely activated and pancreatitis results. This is apparently the most common pancreatitis mechanism in humans, though it is not very common in veterinary patients.
• Concurrent hormonal imbalance predisposes a dog to pancreatitis. Such conditions include: Diabetes mellitus, Hypothyroidism, and Hypercalcemia. The first two conditions are associated with altered fat metabolism which predisposes to pancreatitis and the latter condition involves elevated blood calcium which activates stored digestive enzymes.
• Use of certain drugs can predispose to pancreatitis (sulfa containing antibiotics such as trimethoprim sulfa, chemotherapy agents such as azathioprine or L-asparaginase, and the anti-seizure medication potassium bromide). Exposure to organophosphate insecticides has also been implicated as a cause of pancreatitis. Exposure to steroid hormones have traditionally been thought to be involved as a potential cause of pancreatitis but this appears not to be true. Steroids are able to cause an increase in pancreatic lipase blood tests, though at this point diagnostic tests for pancreatitis have moved towards more specific assays.
• Trauma to the pancreas as from a car accident or even surgical manipulation can cause inflammation and thus pancreatitis.
• The presence of a tumor in the pancreas can lead to inflammation in the adjacent pancreatic tissue.

Miniature Schnauzers are predisposed to pancreatitis as they commonly have altered fat metabolism.

SIGNS OF PANCREATITIS

The classical signs in the dog are appetite loss, vomiting, diarrhea, painful abdomen, and fever or any combination thereof.
MAKING THE DIAGNOSIS

A reliable blood test has been lacking for this disease until recently. Traditionally, blood levels of amylase and lipase (two pancreatic digestive enzymes) have been used. When their levels are especially high, this has been felt to be a reasonable sign that these enzymes have leaked out of the pancreas and pancreatitis is present but, still, these tests are not as sensitive or specific as we would prefer. Amylase and lipase can elevate dramatically with corticosteroid use, with intestinal perforation, kidney disease, or even dehydration. Some experts advocate measuring lipase and amylase on fluid from the belly rather than on blood but this has not been fully investigated and is somewhat invasive.

A newer test called the “PLI” or “pancreatic lipase immunoreactivity” test has come to be important. As mentioned, lipase is one of the pancreatic digestive enzymes and only small traces are normally present in the circulation. These levels jump dramatically in pancreatitis and the diagnosis can be confirmed with a less expensive and non-invasive test. The PLI test is different from the regular lipase level because the PLI test measures only lipase of pancreatic origin and thus is more specific. The problem is that technology needed to run this test is unique and the test can only been run in certain facilities on certain days. Results are not necessarily available rapidly enough to help a very sick patient.

More recently a new test called the SPEC cPL (“specific canine pancreatic lipase”) test has become available. This test is a newer generation immunological test for canine pancreatic lipase and can be run overnight by a reference lab. This test is able to detect 83% of pancreatitis cases (the test is 83% sensitive) and excludes other possible diseases in 98% of cases (i.e. the test is 98% specific for pancreatitis). The test can be run in a laboratory yielding an actual number that can be used for monitoring the patient or it can be run as an in-house test kit. The in-house test kit yields a negative or positive (for pancreatitis) result rather than an actual number that can be used for monitoring. A negative in-house test rules out pancreatitis but a positive test is best followed by the laboratory test so an actual number can be obtained.

Radiographs can show a widening of the angle of the duodenum against the stomach which indicates a swelling of the pancreas. Most veterinary hospitals have the ability to take radiographs but this type of imaging is not very sensitive in detecting pancreatitis and only is able to find 24% of cases.

Ultrasound, on the other hand, detected 68% of cases and provides the opportunity to image other organs and even collect fluid from the belly easily. Since pancreatitis can be accompanied by a tumor in the vicinity of the pancreas, ultrasound provide the opportunity to catch complicating factors such as this.

In some cases, surgical exploration is the only way to make the correct diagnosis.

Dr. Jon Perlis of DVMSound at our hospital performing ultrasound exam.
TREATMENT

The most important feature of treatment aggressively rehydrating the patient with intravenous fluids as this restores the circulation to the pancreas and supports the natural healing mechanisms of the body. This means that the best route to recovery involves hospitalization. Fluids are continued until the patient is able to reliably drink and hold down adequate fluid intake, a process which commonly takes the better part of a week. Pain medication and nausea medication are needed to keep the patient comfortable, restore interest in food, and prevent further dehydration.

Plasma transfusion is somewhat controversial in the treatment of pancreatitis. On one hand, plasma replenishes some of the natural blood proteins that are consumed by circulating digestive enzymes and would seem to make sense in pancreatitis treatment. In humans with pancreatitis, however, no benefit has been shown with plasma transfusion. Whether or not the protection afforded by plasma is real or theoretical is still being worked out but since it is difficult to go wrong with a plasma transfusion, do not be surprised if your veterinarian uses this approach.

In the past, nutritional support was delayed in pancreatitis patients as it was felt that stimulating the pancreas to secrete enzymes would encourage the on-going inflammation but this theory has been re-thought. Currently, earlier return to feeding has been found to be beneficial to the GI tract’s ability to resume function. If nausea control via medication does not produce a reasonable appetite in the patient, assisted-feeding is started using a fat-restricted diet. Return of food interest and resolution of vomiting/diarrhea generally means the patient is ready for return to the home setting. Low fat diets are crucial to management of pancreatitis and their use should be continued for several weeks before attempting return to regular dog food. Some dogs can never return to regular dog food and require prescription low fat foods indefinitely.

BEWARE OF DIABETES MELLITUS

When the inflammation subsides in the pancreas, some scarring is inevitable. When 80% of the pancreas is damaged to an extent that insulin cannot be produced, diabetes mellitus results. This may or may not be permanent depending on the capacity for the pancreas’ tissue to recover. For more information on the management of diabetes, see the Diabetes Center on this web site.