



Diabetes

Causes of Diabetes

Diabetes is a deficiency in insulin that makes it difficult for the body to regulate energy metabolism. There are two types of diabetes, commonly referred to as type I and type II.

In type I, sometimes called juvenile-onset or insulin-dependent diabetes, the pancreas doesn't make insulin. This is a permanent condition that generally results from damage to the pancreas.

In type II, also known as adult-onset or insulin-independent diabetes, the pancreas is making insulin but not enough to meet the demands of the tissues. This is also known as insulin resistance. Type II diabetes is associated with obesity, hormone abnormalities and steroids. Animals with type II diabetes can go into remission.

Dogs usually get type I diabetes and rarely get type II diabetes, while cats can get either type I or type II.

There are two major causes of type I diabetes in dogs. The first and most common cause is immune-mediated destruction of the pancreas. The reason for this autoimmune attack is unknown. Immune-mediated conditions often start in young to middle-aged animals, but they can occur in older animals. The second most common cause of type I diabetes is severe recurrent pancreatitis. In pancreatitis, the digestive enzymes produced by the pancreas begin to attack the pancreas itself. The pancreas normally produces an inactive form of digestive enzymes that are later activated in the gastrointestinal tract. In pancreatitis, these enzymes become activated in the pancreas instead and start to digest the pancreas itself.

Complications of Diabetes

The two common disturbances with diabetes are hyperglycemia (high glucose levels) and hypoglycemia (low glucose levels). Diabetes is characterized by hyperglycemia, and although it is undesirable to be hyperglycemic it is not usually life-threatening. However, severe hyperglycemia can eventually result in a condition called diabetic ketoacidosis, which can be fatal. It is most common in animals with undiagnosed diabetes that are not undergoing any insulin treatment.

In contrast, hypoglycemia can become very dangerous very quickly, even in diabetics that are receiving appropriate insulin therapy regularly. Therefore, it is important to recognize the signs of hypoglycemia and catch them early. The first sign to look for is abnormal behavior. Your dog may start acting "off" or not like his usual self. At this point, it is important to offer food. You can also check its glucose at home to see if it is low (see Monitoring Diabetes, below) and then offer it some food once you have confirmed that the behavior is due to hypoglycemia. If this first subtle sign of hypoglycemia is missed, the next sign you will commonly see is tremors, or possibly a seizure. If your dog is having tremors, it is a good idea to offer it food first. If it is unresponsive or refuses to eat, you can rub some corn syrup (e.g. Karo syrup) on its gums and then bring it to the veterinarian immediately. There are



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many causes of shivering in dogs that may resemble the tremors of hypoglycemia. The best way to distinguish between hypoglycemic tremors and other causes of shivering is to check blood glucose levels.

The most common complication of diabetes in dogs is cataract formation. Another complication in cats and very rarely dogs is polyneuropathy. Unlike humans, dogs are not at risk for vascular disease and stroke, as these are consequences of long-term (lasting decades) hyperglycemia.

It's important to realize that because of diabetes, your dog is at a risk for more problems (hyperglycemia, severe dehydration) if he/she becomes ill. Therefore, if he/she becomes sick or starts vomiting, it is important that he/she see a veterinarian as soon as possible. In addition, hyperglycemia inhibits the immune response, so healing may be impaired in diabetic animals.

Diabetes does not necessarily cause a gradual decline in health, as long as the necessary treatments are in place and infections are avoided. A dog's lifespan is not directly shortened by diabetes.

Treatment of Diabetes

Your dog will require insulin for the rest of his/her life. Unfortunately, oral therapies are not applicable to type I diabetes. Insulin pumps, which are available for humans, are not practical in dogs and cats. Although research groups are investigating alternatives like islet cell transplant or slow-release insulin pellets under the skin, these are not yet available, even at the clinical trial stage. Therefore, insulin injections are the only treatment currently available for your dog's diabetes.

There are many types of insulin on the market. NPH is a common long-term insulin treatment for dogs. Other types of insulin exist for dogs, such as synthetic insulin (glargine, detemir) but these are expensive and are usually reserved for patients that don't respond to NPH treatment. There is also a type of insulin known as "regular" insulin; despite the name, it is generally used in hospital because it lasts for only a few hours and is not suitable for at-home use. Each type of insulin requires a specific type of syringe. NPH uses U100 syringes, which can be bought at human drugstores. Insulin should be stored at a stable temperature. Bottles should be replaced every one–three months once opened. Before drawing up the insulin in the syringe, the bottle should be gently rolled (not shaken) to mix it. There are many good websites that describe insulin handling and administration, if you'd like to read more. Many sites for humans with diabetes apply, and there are pet specific sites too: www.vetmed.wsu.edu/cliented/diabetes.aspx; www.petdiabetes.com/pdorg/insulin.html.

Insulin injections are usually given twice daily, and should be administered at the same time of day each day; however, this can be slightly flexible. If you normally give your dog insulin at 8 p.m., you could give it at 7 p.m. or 9 p.m. if necessary, but you should aim for as close to 8 p.m. as possible. It is ideal to give insulin injections 15–30 minutes before a meal is consumed, and it is best to feed only two meals a day to diabetic patients. This is not always

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possible for all dogs. The injection itself can be given anywhere there is loose skin (e.g. neck, flank, rump), and varying the sites is recommended to avoid irritation.

Nutrition is an important part of diabetes treatment. In dogs, the goal of a good diabetic diet is high-fiber content (to slow the absorption of sugar) and low fat (to avoid obesity). There are prescription diets available for diabetes management that specifically address these concerns. You should avoid treats with a high carbohydrate content, such as Milk-Bones, and instead use light treats that are usually higher in fiber. Green beans and other vegetables are a good alternative to store-bought treats, and are low in carbohydrates. Don't feed raisins or grapes, as they can be toxic for dogs, as are onions.

Another good adjunctive treatment for diabetes is exercise. Encouraging your dog to be active consistently by playing or going on walks should be part of its treatment. Exercise changes the way the cells in the body use insulin, so incorporating a steady exercise regimen into your dog's life is important. In addition, exercise and diet together will help your dog maintain a healthy body condition. It is important that your dog not gain weight, as this will affect how much insulin is needed and may cause it to become unregulated.

Finally, an important part of treatment of dogs with diabetes is to avoid infection. Infections make it more difficult for the body to use insulin. The two common causes of infection in dogs with diabetes are urinary tract infections and dental disease. Urinary tract infections are common in dogs with diabetes for several reasons. First, diabetic animals have more dilute urine than healthy animals. This allows for bacterial growth since the chemicals present in concentrated urine, which normally kill bacteria, are diluted. Second, the urine of diabetic animals contains sugar, which attracts bacteria and helps facilitate bacterial growth. Finally, dogs with diabetes will often have distended bladders because they drink more, and this allows bacteria to be in contact with the bladder for longer than it should. Often diabetic animals won't show any of the classical signs of a urinary tract infection. If left untreated, urinary tract infections can move up the urinary system into the kidneys, causing more severe problems. Therefore, your dog should be checked for a urinary tract infection by doing a urine culture twice a year. Routine dental care, which can include at home tooth brushing, but must include evaluation and occasional deep cleaning by a veterinarian, also helps prevent infections that can affect insulin responsiveness.

Monitoring Diabetes

The most important part of monitoring a diabetic animal involves watching its attitude and behavior. You should ask yourself the following questions: is my dog happy, active, behaving normally, maintaining a normal weight, drinking and urinating normally? Is there any evidence of hypoglycemia or acidosis?

Measuring glucose is another other way to monitor patients with diabetes. Glucose can be measured in the urine or in the blood. Urine glucose fluctuates a lot, and is more beneficial for monitoring glucose in cats with type II diabetes. Blood glucose is preferred for monitoring diabetes in dogs. Spot glucose checks are a glucose measurement at a single point in time, and don't provide any information about how well an animal is being

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regulated. It is useful for detecting hypoglycemia, however, and can be used when hypoglycemia is suspected. A glucose curve is a collection of spot glucose measurements that are taken every two hours over a period of 12-24 hours. These measurements are then plotted on a graph to create a curve. Glucose curves are useful for monitoring regulation, as they tell you the high and low glucose concentrations and how long the patient stays in a good range. An alternative to taking multiple blood samples to build the glucose curve is using a continual glucose monitor. These are available at specialty and referral centers and take glucose measurements every five minutes for up to three days. They are indicated for animals that are hard to regulate.

Blood glucose levels reflect the body's situation at that moment in time. It is possible to measure the body's blood glucose over a longer period by measuring fructosamine instead of glucose. Fructosamine tests measure how much sugar is added to a normal body protein (albumin) and reflects blood glucose over about five days. It is similar to a glycosylated hemoglobin test in humans.

The above tests for glucose can easily be conducted in a veterinary hospital setting. The major disadvantage of this is that dogs become stressed in the hospital, and stress alone can cause hyperglycemia. To avoid this, blood glucose can also be measured at home with a glucometer. Measurements can be used for spot glucose to check for hypoglycemia, or they can be used to build a glucose curve to monitor regulation. In a well-regulated dog, it would be ideal to check blood glucose curves every few months. Both human and canine glucometers are available for purchase, and they require only a small volume of blood for measurements. You can visit www.alphatrakmeter.com for more information on how to measure blood glucose at home, including instructions on how to use a glucometer and build a glucose curve.

Special Circumstances

What if your dog is not eating? If your dog doesn't eat and still receives insulin, it risks becoming hypoglycemic. If your dog doesn't eat breakfast, give half the usual dose of insulin and monitor at home. However, if it misses the next meal, do **not** give insulin as this may cause glucose levels to drop dangerously low. Contact a veterinarian if your dog is not eating.

What if your dog needs a surgical procedure such as a dental cleaning? Your dog can receive its normal feeding and insulin regimen the day before the surgery. By midnight, food should be pulled and withheld until after surgery. The morning of the surgery, give your dog half the normal dose of insulin without food. After your dog wakes up from surgery, the veterinary staff can feed it and give insulin, and you can resume the normal feeding and insulin schedule as soon as your dog returns home.

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