

Diabetes Mellitus in Dogs

**What is diabetes mellitus?**

There are two forms of diabetes in dogs: diabetes insipidus and diabetes mellitus. Diabetes insipidus is a very rare disorder that results in failure to regulate body water content. Diabetes mellitus is a fairly common disorder and is most often seen in dogs five years of age or older. A congenital (existing at birth) form of this disease can occur in puppies, but this is not common.

Diabetes mellitus is a disease of the pancreas. This is a small but vital organ that is located near the stomach. It has two significant populations of cells. One group of cells produces the enzymes necessary for proper digestion. The other group, called beta-cells, produces the hormone insulin. Simply put, diabetes mellitus is a failure of the pancreas to produce adequate amounts of insulin.

**Why is insulin so important?**

The role of insulin is much like that of a gatekeeper: It stands at the surface of body cells and opens the door, allowing glucose to leave the blood stream and pass inside the cells. Glucose, or blood sugar, is a vital substance that provides much of the energy needed for life and it must work inside the cells.

Without an adequate amount of insulin, glucose is unable to get into the cells. It accumulates in the blood, setting in motion a series of events which can ultimately prove fatal.

When insulin is deficient, the cells become starved for a source of energy. In response to this, the body starts breaking down stores of fat and protein to use as alternative energy sources. This causes the dog to eat more, but ultimately results in weight loss.

The body tries to eliminate the excess glucose by excreting it in the urine. However, glucose attracts water, so the urine glucose that is excreted also contains large quantities of the body's fluids. This causes the dog to produce a large amount of urine. To avoid dehydration, the dog drinks more and more water.

Thus, we have the four classical signs of diabetes:

* Weight loss
* Increased water consumption
* Ravenous appetite
* Increased urination

**How is diabetes mellitus diagnosed?**

The diagnosis of diabetes mellitus is based on three criteria: the four classical signs, the presence of a persistently high level of glucose in the blood stream and the presence of glucose in the urine.

The normal level of glucose in the blood is 80 to 120 mg/dl. It may rise to 250 to 300 mg/dl following a meal. However, diabetes is the only common disease that will cause the blood glucose level to rise above 400 mg/dl. Some diabetic dogs can have a glucose level as high as 800 mg/dl, but most will be in the range of 400-600 mg/dl.

To keep the body from losing vital glucose, the kidneys do not allow glucose to be filtered out of the blood stream until an excessive level is reached. This means that dogs with a normal blood glucose level will not have glucose in the urine. Diabetic dogs, however, have excessive amounts of glucose in the blood, so it will be present in the urine.

**What does a diagnosis of diabetes mean for me and my dog?**

For the diabetic dog, one reality exists: Blood glucose cannot be normalized without treatment. Even though a dog can go a day or so without treatment and not experience a crisis, treatment should be looked upon as part of the dog's daily routine. Treatment almost always requires some dietary changes and administration of insulin.

For the owner, successful treatment depends on financial and personal commitment. When your dog is regulated, the maintenance costs are minimal on a day-to-day basis. The special diet, insulin and syringes can initially be expensive. However, the financial commitment can be significant during the initial regulation process or in the instance that complications arise.

Initially, your dog may be hospitalized for a few days to deal with the immediate crisis and to begin the regulation process. The "immediate crisis" is only great if your dog is so sick that he/she has stopped eating and drinking for several days. Dogs in this state, called diabetic ketoacidosis, may require a week or more of hospitalization with quite a bit of laboratory testing. Otherwise, the initial hospitalization is often unnecessary and the initial insulin injections are given at home.

At first, return visits are required every three to seven days to monitor progress. Once the glucose begins to lower, a curve will be recommended to assess how effective the insulin is and how long it is lasting. This is a test in which insulin is injected early in the morning and blood glucose levels are determined every two to four hours throughout the day. The purpose of this test is to determine how long it takes for the blood glucose to reach its lowest level or "peak time." The test is also used to determine how high and low the blood glucose levels are throughout the day. It may take a month or more to achieve good regulation.

We will work with you to try and achieve consistent results, but regulation is not always easy. Inconsistencies in treatment can make regulating your dog especially challenging. It is important that you pay close attention to instructions related to medication administration, diet and home monitoring. Hypoglycemia, or low blood sugar, can occur as a result of incorrect or inconsistent treatment and, if severe, may be fatal.

Your personal commitment to treating the dog is very important in maintaining regulation and preventing crises. Most diabetic dogs require insulin injections twice daily. They must be fed the same food in the same amount on the same schedule every day. If you are out of town, your dog must receive proper treatment while you are gone. These factors should be considered carefully when deciding to treat a diabetic dog.

**What is involved in treatment?**

Consistency is vital to proper management of the diabetic dog. Your dog needs consistent administration of medication, consistent feeding and a stable, stress-free lifestyle. To best achieve this, it is preferred that your dog live indoors most of the time. Although it is not essential, indoor living removes many uncontrollable variables that can disrupt regulation.

The first step in treatment is to alter your dog's diet. Diets that are high in fiber are preferred because they are generally lower in sugar and slower to be digested. This means that the dog does not have to process a large amount of sugar at one time. We recommend Hill's Prescription Diet w/d.

Your dog's feeding routine is also important. Some dogs prefer to eat several times per day. This means that food is left in the bowl at all times for free feeding. However, this is not the best way to feed a diabetic dog.

The preferred way is to feed twice daily, just before each insulin injection. If your dog is currently eating on a free-fed basis, you may try breaking the diet into separate meals.

However, if your dog will not change or if you have several dogs that eat in a free-fed fashion, you may find that this change is not practical. If a two-meals-per-day feeding routine will not work for you, it is still very important that you find some way to accurately measure the amount of food that is consumed.

The foundation for regulating blood glucose is the administration of insulin by injection. Many owners are initially fearful of giving insulin injections. If you are experiencing this reaction, consider these points:

* Insulin does not cause pain when it is injected.
* The injections are made with very tiny needles that your dog hardly feels.
* The injections are given just under the skin in areas in which it is almost impossible to cause damage to any vital organ.

Please do not decide whether to treat your dog with insulin until we have demonstrated the injection technique. You will be surprised at how easy it is.

**About Insulin**

Insulin comes in an airtight bottle that is labeled with the insulin type and the concentration.

Before using, mix the contents. It says on the label to roll it gently, not shake it. The reason for this is to prevent foam formation which will make accurate measuring difficult. Only one type of insulin is meant to be vigorously shaken – Vetsulin. We will tell you whether to roll or shake the insulin depending on what is prescribed.

Some types of insulin used in dogs have a strong tendency to settle out of suspension. If the insulin is not mixed properly, dosing will not be accurate. Therefore, the trick is to roll it enough to mix it without creating foam.

When you have finished rolling it, turn the bottle upside down to see if any white powder adheres to the bottle. If so, more rolling is needed.

Insulin is a hormone that will lose its effectiveness if exposed to direct sunlight or high temperatures. It should be kept in the refrigerator, but it should not be frozen. It is typically not ruined if left out of the refrigerator for a day or two and not exposed to direct sunlight, although this is not advisable. Insulin is safe as long as it is used as directed, but it should be kept out of the reach of children.

Before injecting your dog with the insulin, check that there are no air bubbles in the syringe. If you see an air bubble, draw twice as much insulin into the syringe as you need. Then withdraw the needle from the insulin bottle and tap the barrel of the syringe with your fingernail to make the air bubble rise to the nozzle of the syringe. Gently and slowly expel the air bubble by moving the plunger upward.

When this has been done, check that you have the correct amount of insulin in the syringe. The correct dose of insulin can be assured if you measure from the needle end, or "0" on the syringe barrel, to the end of the plunger nearest the needle.

**Injecting the Insulin**

* Hold the syringe in your right hand (switch hands if you are left-handed).
* Have someone hold your dog while you pick up a fold of skin from somewhere along your dog's back with your free hand.
* Quickly push the sharp, thin needle through your dog's skin. This should be easy and painless. However, take care to push the needle through only one layer of skin and not into your finger or through both layers of the skin roll. The latter will result in injecting the insulin onto your dog's haircoat or onto the floor. The needle should be directed parallel to the backbone or angled slightly downward.
* To inject the insulin, place your thumb on the plunger and push it all the way into the syringe barrel.
* Withdraw the needle from your dog's skin. Immediately place the needle guard over the needle and discard the needle and syringe.
* Stroke your dog to reward him/her for sitting quietly.

**Is continual or periodic monitoring needed?**

It is necessary that your dog's progress be checked on a regular basis. Monitoring is a joint project on which owners and veterinarians must work together.

**Home Monitoring**

Your part consists of two forms of monitoring. First, you need to be constantly aware of your dog's appetite, weight, water consumption and urine output.

You should be feeding a constant amount of food each day, which will allow you to be aware of days that your dog does not eat the whole meal or is unusually hungry after the feeding.

You should weigh your dog at least once monthly. It is best to use the same scale each time.

Also try to develop a way to measure water consumption. The average dog should drink no more than 7-1/2 ounces of water per 10 pounds of body weight in 24 hours. Since this is highly variable from one dog to another depending on weather and amount of exercise, keeping a record of your dog's water consumption for a few weeks will allow you to establish what is normal for your dog.

Any significant change in your dog's food intake, weight, water intake or urine output is an indicator that the diabetes is not well controlled. We should see your dog at that time for blood testing.

The second method of home monitoring is to determine the presence of glucose in the urine. If your dog is properly regulated, there should be very little glucose present in the urine. There are several ways to detect it. You may purchase urine glucose test strips in any pharmacy. They are designed for use in humans with diabetes, but they will also work in dogs.

A fresh urine sample should be collected and tested with the test strip. If a high glucose level is detected, the test should be repeated the next two days. If a high glucose level is present each time, we should see your dog for a blood test.

You should keep a small container to catch urine as the dog voids. A large amount of urine is not needed to test for urine glucose; therefore, it is not necessary to catch the entire amount of urine.

Because the female dog usually squats to urinate, a shallow pan or saucer may be placed under the hindquarters when she begins to urinate. For male dogs, urine can be collected as soon as the dog lifts the leg to void. Male dogs often urinate small amounts in several different places and most often urinate on vertical objects, such as bushes and trees.

**Monitoring of Blood**

A blood glucose level should be performed every three to four months if your dog seems to be well regulated. Testing should also be done if at any time the clinical signs of diabetes are present or if a high glucose level is detected in the urine for two consecutive days.

Timing is important when the blood glucose level is determined. Since eating will elevate the blood sugar for several hours, it is best to test the blood at least four to six hours after eating and administration of the insulin.

One alternative test is called a fructosamine test. This test is an average of the blood glucose levels for the last two weeks. It is less influenced by stress and inconsistencies in diet and exercise. For some dogs, this is the preferred test. It does not require fasting and can be performed at any time of the day.

We recommend a complete physical exam, a blood panel including a serum fructosamine level and a urinalysis twice yearly on diabetic dogs. This will help ensure your dog is properly regulated and aid us in early detection of metabolic problems which may lead to poor control.

**Does hypoglycemia occur in dogs?**

Hypoglycemia means low blood sugar. If a dog's glucose level is below 40 mg/dl, it can be life-threatening.

Hypoglycemia occurs when the insulin dose is too high or when too much insulin is given.

**When the insulin dose is too high**

Although most dogs will require the same dose of insulin for long periods of time, it is possible for the dog's insulin requirements to change. However, the most common causes for change are a reduction in food intake and an increase in exercise or activity. The reason for feeding before the insulin injection is to know when the appetite changes.

If your dog does not eat, skip that dose of insulin. If only half of the food is eaten, just give half a dose of insulin. Always remember that it is better for the blood sugar to be too high than too low.

**When too much insulin is given**

This can occur because the insulin was not properly measured in the syringe or because two doses were given. You may forget that you gave it and repeat it or two people in the family may each give a dose. A chart to record insulin administration will help prevent the dog from being treated twice.

The most likely time that a dog will become hypoglycemic is during peak insulin effect (five to eight hours after an insulin injection). When the blood glucose level is only mildly low, the dog will be very tired and unresponsive. Within a few hours, the blood glucose level will rise and your dog will return to normal.

Since many dogs sleep a lot during the day, this important sign is easily missed. Watch for it. It is the first sign of impending problems. If you see it, please bring your dog in for blood testing.

If your dog is slow to recover from this period of lethargy, you should give him/her syrup or honey (one tablespoon by mouth). If there is no response in 15 minutes, a second dose should be given. If there is still no response, contact us immediately for further instructions.

If severe hypoglycemia occurs, a dog will have seizures or lose consciousness. This is an emergency that can only be reversed with intravenous administration of glucose. If it occurs during office hours, come in immediately. If it occurs at night or on the weekend, call our emergency phone number for instructions.