

Diabetes Mellitus in Dogs

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. Your dog has the more common type of diabetes: diabetes mellitus or “sugar diabetes”. This is a fairly common disorder and is most often seen in dogs 5 years of age or older. There is a congenital form that occurs 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 called insulin which helps regulate blood glucose, or sugar. Diabetes mellitus is a failure of the pancreas to produce the insulin necessary to control the blood glucose.

The Types of Diabetes

In humans, two types of diabetes mellitus have been discovered. Both types are similar in that there is a failure to regulate blood sugar, but the basic mechanisms of disease differ somewhat between the two groups.

1. Type I, or Insulin Dependent Diabetes Mellitus, results from total or near-complete destruction of the beta-cells. This is the only type of diabetes known in dogs. As the name implies, dogs with this type of diabetes require insulin injections to stabilize blood sugar.

2. Type II, or Non-Insulin Dependent Diabetes Mellitus, is different because some insulin-producing cells remain. However, the amount produced is insufficient, there is a delayed response in secreting it, and the tissues of the body are relatively resistant to it. People with this form may be treated with an oral drug that stimulates the remaining functional cells to produce or release insulin in an adequate amount to normalize blood sugar. Because Type II diabetes does not occur in dogs, oral medications are not appropriate for treating diabetic dogs.

The Purpose of Insulin

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 pass inside the cells. Glucose 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 that 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. As a consequence, the dog eats more; thus, we have weight loss in a dog with a ravenous appetite. The body tries to eliminate the excess glucose by excreting it in the urine. However, glucose (blood sugar) attracts water; thus, urine glucose takes with it large quantities of the body's fluids, resulting in the production of a large amount of urine. To avoid dehydration, the dog drinks more and more water. Thus, we have the four classical signs of diabetes:

CLASSICAL SIGNS OF DIABETES MELLITUS:

Weight loss
Ravenous appetite
Increased water consumption
Increased urination

Diagnosis

The normal level of glucose in the blood is 80-120 mg/dl. It may rise to 250-300 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 will have a glucose level as high as 800 mg/dl, although most will be in the range of 400-600 mg/dl.

To keep the body from losing its needed 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 Diabetes Means to You and Your Dog

For the diabetic dog, one reality exists: blood glucose cannot be normalized without treatment. Treatment should be looked upon as part of the dog's daily routine consisting of dietary changes and administration of insulin.

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 sick and has quit eating and even drinking. Dogs in this state, called ketoacidosis may require a week or more of hospitalization with quite a bit of laboratory testing. Otherwise, the initial hospitalization may be only for a couple of days to get some testing done and to begin treatment. At that point, your dog goes home for you to administer medication. Return visits to your regular veterinarian will be required to monitor progress. It may take a month or more to achieve good regulation.

Your veterinarian will work with you to try and achieve consistent regulation, but a few dogs are difficult to keep regulated. It is important that you pay close attention to instructions related to administration of medication, to diet, and to home monitoring. Another complication that can arise is hypoglycemia, or low blood sugar; if severe, it may be fatal. This may occur due to inconsistencies in treatment. This will be explained in subsequent paragraphs.

Your personal commitment to treating this dog is very important in maintaining regulation and preventing crises. Most diabetic dogs require insulin injections once or twice daily. They must be fed the same food 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 before deciding to treat a diabetic dog.

Treatment

Treatment often includes altering 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. Your veterinarian can discuss which specific diet s/he recommends. 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 choice feeding. Another way is to feed twice daily, just before each insulin injection.

The foundation for regulating blood glucose is the administration of insulin by injection. Many people are initially fearful of giving insulin injections. If this is your initial reaction, consider these points.

- 1) Insulin does not cause pain when it is injected.
- 2) The injections are made with very tiny needles that your dog hardly feels.

You will be pleasantly surprised at how easy it is.

The injection technique is as follows:

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. Some of the types of insulin used in dogs have a strong tendency to settle out of suspension. If it is not resuspended it will not mix well, and dosing will not be accurate.

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 not ruined if left out of the refrigerator for a day 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 reach of children.

Drawing up the Insulin. Have the syringe and needle, insulin bottle, and dog ready. Then, follow these steps:

- 1) Remove the guard from the needle.
- 2) Carefully insert the needle into the insulin bottle.
- 3) Withdraw the correct amount of insulin into the syringe.

Before injecting your dog with the insulin, check that there are no air bubbles in the syringe. If you get 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 finger 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. The steps to follow for injecting insulin are:

- 1) Hold the syringe in your right hand (switch hands if you are left-handed).
- 2) Pick up a fold of skin from somewhere along your dog's side with your free hand (pick up a different spot each day). Using the skin on the side of the chest is usually the easiest site. Do not use the skin on the back of the neck or in the "scruff" area.
- 3) Quickly push the needle through your dog's skin. This should be easy and painless. The needle should be directed parallel to the backbone or angled slightly downward.
- 4) To inject the insulin, place your thumb on the plunger and push it all the way into the syringe barrel.
- 5) Withdraw the needle from your dog's skin. Immediately place the needle guard over the needle and discard the needle and syringe.
- 6) Stroke your dog to reward it for sitting quietly.
- 7) If the skin or hair is wet following an injection, the injection was not done properly.

Although the above procedures may at first seem complicated and somewhat overwhelming, they will very quickly become second nature. Your dog will soon learn that once or twice each day it has to sit still for a few minutes. In most cases, a reward of stroking results in a fully cooperative dog that eventually may not even need to be held.

Monitoring

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. 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. Your veterinarian should see your dog at that time for blood testing.

Hypoglycemia

Hypoglycemia means low blood sugar. If it is below 40 mg/dl, it can be life threatening. Hypoglycemia occurs under two conditions:

- 1) *If 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 so you can 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 a half dose of insulin. *Always remember that it is better for the blood sugar to be too high than too low.*
- 2) *If 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 to prevent the dog being treated twice.

The most likely time that a dog will become hypoglycemic is the time of peak insulin effect (5-8 hours after an insulin injection). When the blood glucose is only mildly low, the dog will be very tired. 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 in your dog for blood testing.

If your dog is very lethargic, you should give it corn syrup then call or see your veterinarian.

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, give corn syrup as directed above and see a veterinarian immediately.

