DANADA VETERINARY HOSPITAL, P.C.

# 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. On the other hand, diabetes mellitus is a fairly common disorder that affects the body's ability to regulate blood sugar. Diabetes mellitus 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 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. Diabetics lack the ability to produce insulin. As a result, they cannot regulate their blood sugar.

## *The Types of Diabetes Mellitus*

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 between the two groups.

> **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.
>
> **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 dog's body are 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/Symptoms*

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 move from the blood stream into 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 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,

diabetic dogs eat more but lose weight despite their ravenous appetite. Meanwhile, the body tries to eliminate the excess glucose by excreting it in the urine. However, glucose attracts water. Therefore, 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:

Weight Loss
Ravenous appetite
Increased water consumption
Increased urination

### *Diagnosis*

The diagnosis of diabetes mellitus is based on three criteria: the classical clinical 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 80-120 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. To keep the body from losing necessary sugars, 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. Although the dog can go a few days without treatment and not get into 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 owners, diabetes brings with it a financial and time commitment that can be substantial. When your dog is well regulated, the maintenance costs are minimal. However, the financial commitment is significant during the initial regulation process and if complications arise.

Initially, your dog may need to be hospitalized for a few days to deal with the immediate crisis and to begin the regulation process. This is usually only necessary if your dog is so sick that it has quit eating and drinking for several days. This state is called ketoacidosis, and it can be fatal if not treated aggressively. Treatment requires aggressive fluid and insulin therapy and may also entail a number of laboratory tests. Once appetite and drinking habits are restored, patients can begin the normal regulation process.

If your dog is eating and drinking well at the time of diagnosis treatment may begin at home. The body takes 7-10 days to adapt to changes in insulin doses, so initial regulation can be a frustrating process that requires patience. At first, recheck visits are required every 10-14 days to monitor progress. It may take a month or more to achieve good regulation. At each recheck, urine and blood glucose levels will be

checked until we find a dose that keeps both levels in an acceptable range. Financial commitment varies for this stage based on the number of dose adjustments that need to be made.

Complicating factors such as concurrent illnesses can make regulation a more difficult and lengthy process. If blood sugar levels are not responding as expected, additional testing may be necessary to screen for other illnesses such as urinary or dental infections. Additionally, dogs that use medications such as steroids can be more challenging to regulate for diabetes.

### *Treatment*

Consistency is vital to proper management of a 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. Indoor living removes many uncontrollable variables such as stresses from temperature extremes, and accidental ingestion of wildlife or other food substances that may not be part of the normal routine. These variables can disrupt regulation of diabetes because they are unpredictable.

**Diet**-The first step in treatment is to alter your dog's diet. Diets that are high in fiber are preferred because they are 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. The preferred diets are Hill's Prescription Diet w/d, Purina OM, and Purina DCO. If your dog is overweight, Hill's Prescription Diet r/d is fed until the proper weight is achieved, then your dog is switched to one of the others. Some dogs can be regulated using their regular diet, but these special foods can help to lessen the insulin requirements and can make regulation easier. Your dog's feeding routine is also important. Dogs should keep their normal feeding schedule whether they eat in meals or graze all day. Feedings should remain consistent in terms of the amount being fed and the timing of the meals. Grazing dogs need to have their dietary consumption closely monitored to ensure they eat consistently. Treats should be limited and offered at the same rate each day. The more variable a dog's diet and treat intake are, the harder it is to accurately dose their insulin.

**Insulin**-Insulin is released from a normal pancreas in response to dietary intake of sugars. When too much sugar is present in the blood, insulin helps to lower it. When the body lacks sugar, insulin production is suppressed allowing for sugar levels to rise. Diabetic animals cannot make insulin on their own. Therefore, they must rely on supplementation of insulin to manage their sugar levels. Many people are initially fearful of giving insulin injections. Before beginning an insulin regiment, we will demonstrate the process for you and have you practice with injections to ensure your comfort level. It is important to note that insulin injections are made with small needles that are painless to the dogs receiving them. They are also given in an area of the body that is void of any vital organs, so accidental injury is very unlikely. After seeing the procedure and trying it, most people are pleasantly surprised at how easy it is.

### *Insulin Care and Storage*

Insulin comes in an airtight bottle that is labeled with the insulin type and the concentration. Before using, mix the contents. To mix, roll the bottle gently or invert it multiple times. Do not shake the bottle vigorously as it may lead to foam formation which will make accurate dosing difficult. 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. Insulin is safe if 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 and insert the needle into the bottle of insulin.
2) Draw back on the plunger to allow the insulin to fill the syringe to the appropriate level.
3) Before injecting your dog with insulin, check that there are no air bubbles in the syringe. If you get an air bubble, draw out slightly more insulin than is required 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. Return the excess insulin to the bottle.

***Injecting the Insulin***

1) Hold the syringe in your dominant hand.
2) Have someone hold your dog while you pick up a fold of skin from somewhere along your dog's back with your free hand. (The same area can be used each day).
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. There should be little to no resistance when injecting.
5) Withdraw the needle from your dog's skin. Immediately place the syringe and needle in a sharps container. It is not necessary to recap the needle if disposed of in an appropriate container.

Note: Syringes and needles cannot be thrown in regular trash. However, a full sharps container can be disposed of in the trash if sealed and labelled appropriately. A home-made sharps container can be made from a coffee can or milk container. When full, the cap must be taped on, and the container must be clearly marked as “sharps” and/or” biohazard.”

Although the above procedures may at first seem complicated and overwhelming, they will very quickly become second nature. Your dog will soon learn that once or twice each day it must sit still for a few minutes. Rewarding them with praise and affection can help to encourage routine cooperation as well.

## *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.

***At-Home Monitoring***

At-home monitoring of diabetes usually consists of observing for weight loss, ravenous appetite, and excessive drinking and/or urination. You should be feeding a constant amount of food each day that will

allow you to be aware of days that your dog does not eat all of it or is unusually hungry after the feeding. You should weigh your dog at least once a month. It is best to use the same scales each time.

You should develop a way to measure water consumption. The average dog should drink no more than 1-2 oz. per pound of body weight. Since this is highly variable from one dog to another, 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 diabetes is not well controlled. We should see your dog at that time for blood testing.

***Monitoring of Blood Glucose***

Determining the level of glucose in the blood is the most accurate means of monitoring. This should be done every 10-14 days until the diabetes is under control. Once your dog is regulated well, monitoring is recommended every 3-6 months. It should also be done at any time the clinical signs of diabetes are present. Glucose monitoring is done in one of the following ways:

*Glucose Curves*-This is the most common test for monitoring blood sugar. This test requires your dog to spend the day at the hospital with us. We measure blood sugar every two hours for 8-12 hours. This allows us to see the trend in blood sugar levels throughout the day. Ideally, the glucose should be between 100-250 for the majority of the day. If the levels are too high or too low for a significant part of the curve, the insulin dose is adjusted accordingly.

*Fructosamine*-This test is a measure of circulating protein in the body that binds to sugar in the blood. If there is excessive blood sugar for long periods of time, this protein is more prevalent. Though this test does not specifically measure the blood glucose, fructosamine serves as a rough estimator of how well regulated the blood sugar has been over the previous 2-3 weeks. The advantage of this test is that it can be done in a short appointment rather than requiring a full day at the hospital. The disadvantage is that it does not specifically tell us how high or low the blood sugar gets. For this reason, fructosamine is often run in combination with a single blood sugar reading. The ideal time for this test is 6-8 hours after an insulin injection. In theory, this should coincide with the lowest blood sugar levels of the day. If the blood sugar at this time is above 100 and the fructosamine indicates good to excellent regulation, we can assume the blood sugar never gets too high to too low.

*Urine monitoring*-Urine sampling is routinely done when monitoring diabetics. The urinalysis measures excess glucose in the urine that indicates poor regulation of diabetes. In addition, it measures ketones (dangerous waste products that result from poorly controlled blood sugar.) The last part of this test checks for signs of infection. Excess sugar in the urine provides nutrients that encourage overgrowth of bacteria and can lead to infections frequently. Any infections in the body that are not promptly treated can make diabetic regulation more difficult.

## *Hypoglycemia*

Hypoglycemia means low blood sugar. It will typically occur if too much insulin is given at any one time. In some cases, this can be due to the dose of insulin being too high. Other times it is the result of dosing the

correct dose to an animal that has not eaten or who has already received an injection from another family member. Signs of hypoglycemia include extremely lethargic behavior, staggered walking, and tremors or weakness. In severe cases, seizures and loss of consciousness can occur.

If your dog demonstrates signs of hypoglycemia, you should call us immediately. Having a bottle of corn syrup (Karo Syrup) on hand can be helpful. Dosing a tablespoon per 10 pounds of body weight can help to calm some of the symptoms of low blood sugar in an emergency.

# SUMMARY OF INSTRUCTIONS FOR NEWLY DIAGNOSED DIABETIC DOGS

Keep these instructions as a quick reference for any questions you may have. This is a big change for you and your dog, so no matter how simple a question may seem, do not hesitate to call us if you need help.

Follow the dosing instructions that are on the label of your medication. **Do not alter the dose of insulin unless instructed by your doctor**. Since dogs eat the same diet every day, they do not need insulin adjustments daily like humans do. Such frequent dose changes can be very dangerous for dogs.

**Always use the syringes that are dispensed with your insulin**. Different insulins require different syringe types. The units of a syringe for a U100 insulin (100 units per ml) are vastly different from those of a U40 (40 units per ml) insulin.

**For reference, NPH insulin (Humulin N) is a U100 insulin, Vetsulin is a U40 insulin.

**Insulin should never be given until after your pet has eaten.** If your dog skips a meal, skip their insulin dose. It is much safer for dogs to have high blood sugar for a day than to risk overdosing them with insulin when they do not need it. If they skip multiple meals in a row, call for an appointment.

**Return for a glucose curve in 10-14 days.** Please drop off between 7-7:30 am that morning. Feed and give insulin as you normally would. If you typically feed and dose the insulin after this time, bring the medication and your food to the clinic with your dog. We will check a urine sample at this time as well.