DIABETES

There are several forms of diabetes in dogs: Insipidus ["drinking diabetes"], Juvenile, Mellitus ["sugar diabetes"], and Ketoacidoic Mellitus. Diabetes insipidus is a very rare disorder. There is a congenital form that occurs in puppies called Juvenile Diabetes, but this too is rare. Diabetes Mellitus is much more common in dogs. Ketoacidioc Diabetes is a serious complication of Diabetes Mellitus. This is s life threatening crisis and requires immediate action.

There are four classical signs of Diabetes Mellitus: [1] Weight loss [2] Increased water consumption [3] Increased appetite [4] Increased urination

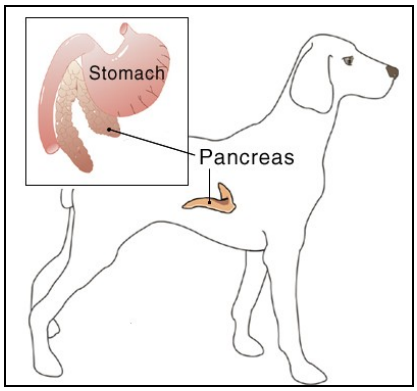
The diagnosis is based on three criteria:

1. **the four classical clinical signs**
2. **the presence of a persistently high level of glucose in the blood stream via blood testing**
3. **the presence of glucose in the urine via urine testing**

Yearly blood and urine testing could catch diabetes or several other illnesses before they have a strong hold on your pet.

Signs of Ketoacidoic Diabetes:

- **has stopped eating and drinking**
- **has not been urinating normally**
- **seems depressed**
- **has been vomiting for several days**



If blood work and/or urine testing determine that your pet has elevated glucose and the above symptoms, the initial diagnosis will be ketoacidoic diabetes. This is a serious complication of Diabetes, mellitus and can be fatal. Hospitalization with frequent laboratory testing will be required while trying to reverse the ketosis.

Diabetes mellitus is a disease of the pancreas. This is a small but vital organ 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 pancreatic beta cells to regulate blood sugar.

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

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, or the tissues of the dog's body are relatively resistant to it. This form of diabetes most commonly occurs in older obese dogs. 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. Unfortunately, dogs do not respond well to these oral medications.

The role of insulin is much like that of a gatekeeper: in effect, 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 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 resulting in the production of a large amount of urine. To avoid dehydration, the dog drinks more and more water.

For the diabetic dog, one reality exists: blood glucose cannot be normalized without treatment. Although the dog can go a day or so without treatment and not have 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.

As for you, the owner, there are two implications: financial commitment and personal commitment.

When your dog is well regulated, the maintenance costs are minimal. The special diet, insulin, and syringes are not expensive. However, the financial commitment may be significant during the initial regulation process and if complications arise. If there is a need for financial assistance, there is an excellent plan called "CareCredit" that our staff would be glad to help you obtain.

The doctor will work with you to try and achieve consistent regulation, but some dogs are difficult to keep regulated. It is important that you pay close attention to all instructions related to administration of medication, diet, and home monitoring. Another complication that can arise is *hypoglycemia*, or low blood sugar, which can be fatal. This may occur due to inconsistencies in treatment. This will be explained in subsequent paragraphs.

Your personal commitment to treating your 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 in the same amount on the same schedule every day.**

- **A stable, stress-free lifestyle will aid in keeping hormones in balance. To best achieve this, it is preferred that your dog live indoors most of the time. Although this is not essential, indoor living removes many uncontrollable variables that can disrupt regulation.**

Diet: Diabetes mellitus is known as a "fiber-responsive disease". Diets 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. Additionally, the fiber may help stimulate insulin secretion. Your veterinarian will discuss specific diet recommendations for your pet's needs.

Your dog's feeding routine is also important. The preferred way is to feed twice daily, just before each insulin injection. If your dog is currently eating on a free choice basis, it is important to try and make the change. If a two-meals-per-day feeding routine will not work for you, it is still important to find some way to accurately measure the amount of food that is consumed.

How to give Insulin Injections

Three facts you should know:

1. **Insulin does not cause pain when it is injected.**

2. **The injections are made with very tiny needles that your dog hardly feels.**

3. **The injections are given just under the skin in areas in which it is almost impossible to cause damage to any vital organ.**

It is neither necessary nor desirable to swab the skin with alcohol to "sterilize" it. There are four reasons:

1) **Due to the nature of the thick hair coat and the type of bacteria that live near the skin of dogs, brief swabbing with alcohol or any other antiseptic is not effective.**
2) **Because a small amount of alcohol can be carried through the skin by the needle, it may actually carry bacteria with it into the skin.**
3) **The sting caused by the alcohol can make your dog dislike the injections.**
4) **If you have accidentally injected the insulin on the surface of the skin, you will not know it. If you do not use alcohol and the skin or hair is wet following an injection, the injection was not done properly.**

Insulin comes in an airtight bottle that is labeled with the insulin type and the concentration. It is important to make sure you match the insulin concentration with the proper insulin needles. Insulin needles show their measurement in "units per ml", which must correspond to the concentration of the insulin you are using.

Before using the insulin, mix the contents. Be sure to roll it gently between your hands. Do not shake it. The reason for this is to prevent foam formation, which will make accurate measuring difficult. Some types of insulin used in dogs have a strong tendency to settle out of

suspension. When you have finished mixing the insulin, turn the bottle upside down to see if any white powder adheres to the bottom of the bottle. If so, more mixing 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. If you have any doubt about your pet's insulin and how it was stored, it is safer to replace it instead of risking using ineffective insulin. 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 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 fingernail to make the air bubble rise to the tip 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.

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

1. **Remove the cap from the needle, and draw back the plunger to the appropriate dose level.**

2. **Carefully insert the needle into the insulin bottle.**

1. **Inject air into the bottle. This prevents a vacuum from forming within the bottle.**

2. **Withdraw the correct amount of insulin into the syringe.**

5. **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 in the "scruff" region with your free hand. Try to pick up a slightly different spot each day.

6. **Quickly push the very sharp, very 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 two layers of skin. 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.**

7. **To inject the insulin, place your thumb on the plunger and push it all the way into the syringe barrel.**
8. **Withdraw the needle from your dog's skin. Immediately place the needle guard over the needle and discard the needle and syringe.**

9. **Stroke and praise your dog to reward it for sitting quietly.**

Be aware that some communities have strict rules about disposal of medical waste material so don't throw the needle and syringe into the trash until you know if this is permissible. It is usually preferable to take the used needles and syringes to your veterinary clinic or local pharmacy for disposal. .

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 your dog's progress

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.

Your part in the monitoring process involves two types 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 consistent amount of food each day, which 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 monthly. It is best to use the same scales each time. You can bring your pet into the hospital anytime we are open and we will glad to weigh him/her for you.

You should develop a way to measure water consumption. The average dog should drink no more than 7 1/2 oz. (225 ml) of water per 10 pounds (4.5 kg) of body weight per 24 hours. 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.

Another way to measure water consumption is based on the number of times it drinks each day. When properly regulated, it should drink no more than six times per day. If this is exceeded, you should take steps to make an actual measurement.

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.

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

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 dog should eat before giving the insulin injection, because once the insulin is administered it can't be removed

from the body. 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 in the short term for the blood sugar to be too high than too low.

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 act very tired and unresponsive. You may call it and get no response. Within a few hours, the blood glucose 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 any subtle signs of hypoglycemia. It is the first sign of impending problems. If you see it, please bring your dog in for blood glucose testing.

If your dog is slow to recover from this period of lethargy, you should give it "Nutrical" (one tablespoon by mouth). If there is no response within fifteen minutes, repeat administration of the "Nutrical". If there is still no response, contact your veterinarian immediately for further instructions.

If severe hypoglycemia occurs, a dog may have seizures or lose consciousness. Ultimately, untreated hypoglycemia will lead to coma and death. This is an emergency that can only be reversed with intravenous administration of glucose. If it occurs during office hours, take your dog to the veterinarian's office immediately. If it occurs at night or on the weekend, call your veterinarian's emergency phone number for instructions.

Monitoring of Blood Glucose

There are 2 blood tests that can be used to monitor your dog, the blood glucose test and the fructosamine test. One of these should be performed every 6 months if your dog seems to be well regulated. Testing should also be done at any time the clinical signs of diabetes are present or if glucose is detected in the urine for two consecutive days.

Determining the level of glucose in the blood is the most commonly used blood test. Timing is important when the blood glucose is determined. Since eating will elevate the blood sugar for several hours, it is best to test the blood at least six hours after eating.

When testing the blood we want to know the highest and lowest glucose readings for the day. The highest blood sugar reading should occur just before an injection of insulin is given. The lowest should occur at the time of peak insulin effect.

If your dog tends to become overly excited or is very nervous when riding in the car or being in the hospital, the glucose readings may be falsely elevated, which would give us limited

information. If you are aware of this possibility, it is best to admit your dog to the hospital the day prior to the testing so it can settle-in overnight for testing the next day.

Another option available: We have the equipment available for in-home testing the glucose curve. This procedure would be accomplished by you, the owner. The testing is done by pricking an ear or a toe.

The proper in-hospital procedure is as follows:

- **Bring your dog to the hospital by _____A.M. in the morning.**
- **DO NOT feed your pet. Bring the morning meal with you. We will feed him/her. If your pet is uncomfortable eating out of normal surroundings, feed your pet then bring to clinic immediately.**
- **DO NOT give the morning Insulin injection. Bring the Insulin with you.**
- **A blood sample will be taken immediately and then we will give insulin.**
- **Blood samples will be taken every 2 hours to determine a glucose curve.**

The 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.

SUMMARY OF INSTRUCTIONS

[_____] Return for a glucose curve, no later than 8:00 a.m., on _____.

- **Feed your dog that morning and immediately bring it to the hospital.**
- **Do not give insulin, but bring it with you. (If it will take more than 30minutes to drive to the hospital, call for instructions on feeding.)**

[_____] Return to our hospital for a blood glucose test on _____. Since this test is the fructosamine level, the time of day is not important and fasting is not necessary.

Give _____units of insulin twice daily.

For the most beneficial effect, we recommend that you give injections within 30 minutes after your pet's meals and keep a consistent 12 hours gap between doses.