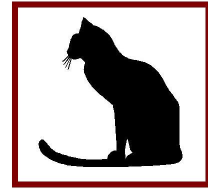


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Diabetes Mellitus in Cats

Your cat has been diagnosed with diabetes mellitus, sometimes called sugar diabetes. It is characterized by insulin deficiency or dysfunction. Insulin is made in the pancreas which 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.

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 to provide energy. Without an adequate amount of insulin, glucose is unable to get into the cells. It accumulates in the blood in excess amounts (*hyperglycemia*), setting in motion a series of events that can ultimately prove fatal if not treated in time.

Types of Diabetes Mellitus

There are two types of diabetes mellitus in cats. 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, (in humans referred to as juvenile onset diabetes) means that no insulin is being produced by the pancreas at all. Cats with this type of diabetes require insulin injections to stabilize blood sugar.
2. Type II is the most common type found in cats. These cats may still make a small amount of insulin. However, the amount produced is insufficient or delayed in its release or the body may be resistant to the insulin. These cats may respond to diet changes and oral medications early in the disease, however, many still require insulin injections to survive.

Profile of a Diabetic Cat

Diabetes is primarily a problem found in middle-aged or older cats. The disease is seen more often in males than in females and in overweight cats. It is also a common problem in cats that have had pancreatitis or inflammatory bowel disease.

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 cat begins to lose weight but eats ravenously (*polyphagia*). The excess insulin eventually begins to spill out into the urine (*glucosuria*). Glucose in the urine causes excessive urination (*polyuria*) and a tremendous thirst (*polydipsia*). Thus; we have the four classical signs of diabetes:

CLASSICAL SIGNS OF DIABETES MELLITUS:

Weight loss and Ravenous appetite
Increased water consumption and Increased urination

Diagnosing Diabetes

The diagnosis of diabetes mellitus is based on several laboratory criteria: the presence of a persistently high level of glucose in the blood stream, the presence of glucose in the urine, and an elevated fructosamine.

The normal level of glucose in the blood is 70-150 mg/dl. It may rise to 250-300 mg/dl following a meal or when the cat is very excited or nervous. However, diabetes is the only common disease that will cause the blood glucose level to rise above 400 mg/dl. Some diabetic cats will have a glucose level as high as 800 mg/dl, although most will be in the range of 400-600 mg/dl.

Normally, the kidneys do not allow glucose to be filtered out of the blood stream until an excessive level is reached. This means that most cats will not have glucose in the urine unless they are diabetics. There are a few other diseases of the kidney that can cause glucose in the urine, so this has to be differentiated from the true diabetic.

The diagnosis of diabetes seems rather simple, and in most cats it is. However, some diabetic cats do not meet all the criteria. For these, another test is performed called fructosamine. This test represents the average blood glucose level for the previous 2-3 weeks. It helps to clarify the cases where stress and eating temporarily elevated the blood glucose.

What to expect if your cat is a diabetic

Managing a cat with diabetes does require commitment and a consistent schedule, but the disease is very manageable. The more you keep the medication, diet, and activity the same from one day to the next, the easier it will be to keep your cat's diabetes well regulated. Diabetic cats without any other serious diseases commonly live well into their "golden years".



If your cat is very sick when the diagnosis is made, he or she may need to be hospitalized for a few days to deal with the immediate crisis and to begin the regulation process. These patients are usually severely dehydrated and have stopped eating or drinking. These cats are often in *ketoacidosis* as they are trying to use ketones instead of the glucose they really need.

Most diabetic cats will require twice daily insulin injections in the skin at the back of the neck, or the "scruff". This may sound a bit scary, but the needle is very tiny and most cats take insulin injections a whole lot better than they take a pill. Some owners report that their cat actually comes to them at insulin time and lifts their neck for the injection! Your cat may need, instead, oral medications (pills or liquid) to help control the diabetes. These medications are also usually given twice daily.

Diet is another key treatment for the diabetic cat. Not only is it important to make sure your diabetic cat is eating well, you will need to make sure that he or she eats a meal with her medications. There are a number of special diets that help control diabetes and you may be asked to switch your cat to one of them.

Like diabetic people, the diabetic cat also requires regular checks of his or her blood sugar level usually once every week or two, depending on how stable they are. In most cases this is done at the clinic, but some cats will allow their owners to check their blood sugar at home so the values can just be called into the clinic for evaluation. It's also important for the diabetic cat to have regular physical exams and blood work in order to find any problems that may interfere with good diabetic control or complications that the diabetes may cause.

About Insulin

Insulin comes in an airtight bottle that is labeled with the insulin type and the concentration. The concentration will be U-40 (meaning 40 units of insulin per ml) or U-100 (100 units of insulin per ml). The syringe you use should match the concentration of the insulin you use. Insulin 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 as long as it is not exposed to direct sunlight or high heat. A new bottle of insulin should be used every 2 months, even if the old one is not empty.

Several types of insulin are available for use in cats, choosing which works best in your cat may take some trial and error. Protamine zinc insulin (**PZI**) is made specifically for cats and obtained from your veterinarian. PZI has a concentration of U-40 and U-40 insulin syringes are used. The other most common type of insulin used in cats is human insulin. It is called **Lantus or Glargine**. This insulin is U-100 in strength and should be measured out with syringes that say U-100. You must not interchange different concentrations of insulin with different syringe sizes or improper dosing will occur.

Injection instructions

Insulin injections need to be given every 12 hours. It's very important to stick very, very close to the same time with each injection. There is about an hour leeway (1 hour before or after your cat's regular injection time) where you can still safely give the injection. For example, if you normally give your cat his insulin at 7 am and 7 pm and you are delayed and can't give the injection until 8 that evening (or if you need to leave early at 6), it's still o.k. to give and you should return to the 7 am time the next morning. But if you are really late and can't give it until 9pm, you should skip the evening injection and restart with his regular dose at the normal 7 am time the next morning. Giving injections too close together can cause low blood sugar (*hypoglycemia*) and this can be life threatening. It's important to not change the injection times or miss doses often.

Have the syringe, needle, insulin bottle, and cat treats ready. Before drawing up the insulin dose mix it by rolling the bottle gently in your hands, do not shake it. One reason for this is to prevent foam formation, which will make accurate measuring difficult; another reason is to prevent breaking down the insulin protein, which inactivates it.

Our technicians will demonstrate how to measure and give the insulin, but you can also review the written instructions in the handout titled "How to Give an Injection" or online at www.felinevideos.vet.cornell.edu/index.shtml

Diet

Unlike dogs, the best diet for a diabetic cat is a high protein, low carbohydrate diet. In general canned or moist foods are always a better choice for the diabetic cat than are dry foods. There are a few prescription diets, like Hill's DM which are developed specifically for diabetic cats. If your cat does not like any of the prescription diets, there are a few commercial diets that can be tried instead. Treats should be high in protein like cooked chicken or tuna. Some cats have other health issues that make changing diets impossible so your veterinarian will make specific recommendations for your cat.

Diabetic cats need to have a very regular feeding pattern. If your cat is normally allowed to free feed (food out all day long), then you should continue this. If, instead, you meal feed at certain times of day it should stay that way. It's also important to make sure you can tell if they are eating a normal amount of food, an increased amount of food or less than normal. If your cat is eating less than normal and you give the usual amount of insulin, they can develop low blood sugar (*hypoglycemia*).

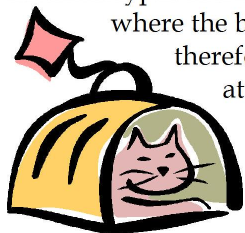
Oral Medications

People have a number of drugs that they can take by mouth that helps control their blood sugar. Cats are not quite so lucky. Most of these medications do not work well in the cat or they have side effects that cause problems for the cat. *Glipizide* is one oral medication that is effective in about 25 % of cats. This can be used along with insulin or by itself to help control the blood sugar levels. It cannot be used in cats that have liver disease and some cats cannot take it as it upsets their digestive tract. Other medications that are occasionally used to assist in blood sugar control include *acarbose*, *chromium picolinate* and *vanadium*. The research has not been fully completed on these compounds. How effective they are in cats is still being studied.

Monitoring

Monitoring is a joint project on which owners and veterinarians must work together. In addition to blood glucose, other laboratory tests will need to be evaluated periodically. Any significant change in your cat's attitude, food intake, water intake, weight, or urine output can indicate that the diabetes is not well controlled or that there is another health issue. For example, diabetic cats are more prone to developing infections especially urinary tract infections because the excess sugar provides easy food for the bacteria. Any changes that your cat exhibits should be reported to us.

The other important part of monitoring the diabetic cat is the blood glucose. Human diabetics will often take their blood sugar several times a day. This is not practical for the cat. We usually aim for checking the blood sugar once a week to every 2-3 weeks if the cat is very stable. Testing is done differently for the different types of insulin. An insulin like PZI usually has a peak time to effect, called a nadir (this is where the blood sugar should be at its lowest) at about 6 hours. Blood tests are usually done, therefore, 6 hours after the cat's morning insulin dose. Sometimes a glucose level is needed at the zero hour also (right after the insulin is given in the morning). Lantus insulin works differently and blood tests are done 4 times a day as there is less of a nadir.



Some cats will allow their owners to do blood testing at home. If you would like to try this, you will need to purchase a blood glucose monitor and test strips. There is now a monitor just for dogs and cats. The training video can be found online. Go to www.northernilcatclinic.com>links>veterinarypartners. In the search box on the Veterinary Partners page enter in: "home glucose testing cats" to find the article with instructions and videos. If you are able to do this, we tell you when and how often to test and you will then call your results into the office so the doctor can interpret the values and make recommendations.

Many cats simply do not allow their owners to do regular testing at home as it's not quite as easy as just giving the injection. Those cats will need to visit the clinic for their testing. These visits may be a bit more frequent in the beginning when we are first trying to stabilize your cat. Eventually, this tends to be about twice a month, usually the visit is 6 hours after the morning insulin dose. It includes an exam, weight check, and blood glucose. The insulin dose is adjusted accordingly.

Hypoglycemia

Causes

Hypoglycemia means low blood sugar. If it is below 40 mg/dl, it can be life threatening. Several things can cause a low blood sugar.

1) *If the insulin dose is too high* for the amount of food eaten. Always make sure your cat is interested in food and eating his normal amount before administering the insulin. *If your cat 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.* And, of course, call the office to get further instructions if your cat is not eating normally.

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 cat being treated twice. If you suspect that an overdose has been given, you need to call the office for instructions or the emergency clinic if it is after hours.

3) *Spontaneous remission of the diabetes.* This is a poorly understood phenomenon, but it definitely occurs in about 20% of diabetic cats. Suddenly the cat's pancreas starts making enough insulin. This happens quickly and unpredictably and often the first sign is a hypoglycemic crisis.

Symptoms and Treatment

The most common time for low blood sugar is 5-8 hours after the insulin was given. You may see that your cat is sleepier, tired, or suddenly very hungry. Pacing or acting restless is also a common symptom. He or she may act uncoordinated, vomit or vocalize. The most serious cases of low blood sugar will be unresponsive when you call to them, unconscious or even have a seizure. If any of these things are seen it's important to immediately get some Karo syrup onto their gums,(in a pinch you can use maple syrup or honey). Once they begin to respond see if you can get them to eat something. Then get them to your veterinarian or the emergency clinic right away.

