

My Cat

has **DIABETES?**

With the proper care this common disease is quite manageable and cats can maintain a good quality of life. Here's what you need to know.



What is diabetes mellitus?

Diabetes mellitus is a condition that develops when the body doesn't produce enough insulin or the insulin that is produced isn't sufficient enough to regulate blood sugar levels. As a result, the body doesn't function as well as it should.

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 cat 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 cat to produce a large amount of urine. To avoid dehydration, the cat drinks more and more water.

Thus, we have the four classical signs of diabetes:

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

Not all of these signs are readily seen in every diabetic cat, but we expect that you will have seen at least two of them.

How is diabetes mellitus diagnosed?

Because the four classical signs of diabetes are also present in other feline diseases, clinical signs alone are not sufficient to make a diagnosis. We also look for a high level of glucose in the blood stream and the presence of glucose in the urine using laboratory tests. The normal blood glucose level for cats is 80 to 120 mg/dL, while diabetic cats often have levels over 400. Diabetic cats also have glucose present in the urine. The combination of these findings in a cat with at least two of the clinical signs of diabetes is sufficient evidence to make a diagnosis of diabetes.

A cat's blood glucose level can be influenced by excitement. "Stress hyperglycemia" can result from a ride in the car and a visit to the veterinary hospital, which may compromise the testing process for diabetes. When this is suspected, a serum fructosamine test can be used. This test gives an average blood glucose reading for the last two weeks. It will be clearly elevated in a diabetic cat.

What does a diagnosis of diabetes mean for my cat?

There are two forms of diabetes in cats: uncomplicated diabetes (the most common form) and ketoacidosis (the life-threatening form). If ketoacidosis is present, the cat is in crisis and must be treated quickly. Intravenous fluids are given and quick-acting insulin is administered. Generally, one to three days of hospitalization are required to stabilize the cat and convert the diabetes to the uncomplicated form.

Uncomplicated diabetes needs treatment, but it is not necessary to achieve regulation of the blood glucose level immediately. As long as the cat is eating and drinking and is not dehydrated, insulin can be gradually worked up to the proper level over days or even weeks.

The first phase of treatment for uncomplicated diabetes is called regulation. This means that insulin is given until the proper dose is found to keep the blood glucose in the range of 100 to 300 mg/dL throughout the day and night. When this occurs, the signs of diabetes are relieved. The cat begins to gain weight and his/her appetite returns to normal. The cat's urination and water consumption also return to normal levels.

The second phase of treatment is called maintenance. This means that the cat has been regulated and has the appearance and behavior of a normal cat. Hopefully, the cat stays in this phase the rest of his/her life. However, some cats require insulin changes with time and new circumstances, so occasional reregulation may be needed.

Diabetic cats are best regulated when as many factors as possible are consistent from one day to the next. For this reason, keeping your cat indoors is preferred. There is no doubt that not all cats will adapt to this lifestyle, but the benefits are substantial in keeping your cat regulated.

When starting insulin, your cat will need to be monitored at the hospital for one to three days for glucose curve testing. You may also perform the blood glucose measurements at home on a glucometer, if you prefer. This would require the purchase of a glucometer. Home glucose testing may sound complicated, but it is actually very quick and easy with practice and will give more accurate results. Once the body has adjusted to the insulin, a glucose curve should be performed again in 10 to 14 days to assess the adequacy of the insulin dose. The curve will be repeated weekly until adequate regulation is achieved.

What does a diagnosis of diabetes mean for me?

There are some serious financial obligations involved in treating a diabetic cat; however, the majority of expenditure occurs during the regulation phase. It is difficult to predict how expensive individual treatment will be because it is entirely dependent on how quickly the cat is regulated. The cost is especially great if the cat is ketoacidotic, but this occurs in less than 10 percent of diabetic cats. Once the cat is stable, the costs for insulin, syringes and rechecks are less expensive and spread out over a longer period of time. The cost can also be reduced if home glucose testing is performed.

Financial commitment is not the only factor to consider, however. This disease also requires a substantial amount of involvement on your part to keep the cat regulated. You will be giving insulin injections twice daily and will need to monitor the cat's progress for any signs that he/she is not well-regulated. If you are not dedicated to keeping your diabetic cat regulated, you will be disappointed with the results and the expenses associated with poor regulation.

What is involved in treatment?

Consistency is vital to proper management of the diabetic cat. Your cat needs consistent administration of insulin, consistent feeding and a stable, stress-free lifestyle.

The first step in treatment is to alter your cat's diet. Ideally, you should measure your cat's food each time it is added to the bowl, noting the amount of uneaten food from the previous filling. This is feasible in some situations, but the presence of several cats in the household can make this difficult. It is important to feed a diet low in carbohydrates and in fact, there are now prescription diets made specifically for diabetic cats. Feeding a canned version of this diet

is ideal. Feeding this type of diet increases the possibility of remission (no longer needing insulin) and also reduces the insulin requirement in cats that do need to stay on it.

The foundation for regulating blood glucose is the administration of insulin by injection.

Tell me more about spontaneous remission of diabetes.

Spontaneous remission occurs when a diabetic cat experiences an unexpected improvement or cure of the disease. When this happens, the pancreas resumes normal function so that insulin injections are no longer needed. This phenomenon is peculiar to the cat and is not uncommon. It is thought to occur in about 50 to 80 percent of diabetic cats on glargine insulin. There are several other types of insulin available for cats and spontaneous remission can occur with these as well.

The first sign of spontaneous remission is hypoglycemia. At the peak time (determined by the glucose curve), the cat will be very unresponsive; however, a few minutes to a few hours later he/she will appear normal. The cat has the ability to respond to hypoglycemia by converting glycogen (stored in the liver) to glucose, but after a few days of this response, glycogen stores are depleted. The cat will become critically hypoglycemic and may die without immediate intravenous glucose.

The key to detecting spontaneous remission is to observe your cat at the peak time. Since this time may occur during the night or when you are at work, you should observe for it closely on weekends or other days when you are at home. If your cat is showing suspicious signs, you can quickly check the blood glucose at home with a glucometer.

Diabetes Home Care

Typically two daily injections of insulin will be required for the rest of your pet's life. Though with some cats, once the blood sugar has been lowered, the dose of insulin may be reduced or eliminated. However, cats may become insulin-dependent again later in life. It is also important that the injections are given at the same times each day, usually every 12 hours. In sporadic occasions if the 12-hour time frame cannot be met, insulin may be given 10-14 hours apart. The injection is given just under the skin (subcutaneous) and is not painful to your pet. Insulin should be given behind the region of the shoulder blades, along the back, changing the site of administration at each administration.

Handling Insulin and Insulin syringes

Insulin is a hormone that will lose its effectiveness if exposed to direct sunlight or high temperatures; therefore, it should be kept in the refrigerator. Insulin when stored properly, should last 6 to 8 weeks. After that time it should be replaced. Insulin should also be replaced prior to getting close to the bottom of the vial because many pets get overdosed as the insulin becomes more concentrated as the bottle is used up.

The bottle should be mixed by rolling or swirling before withdrawal of the insulin into the syringe. The bottle should **NEVER** be shaken to mix the insulin.

The syringe and needle should be stored in protective wrappers to keep them sterile, until ready to use. Insulin should **NEVER** be pre-drawn up into the syringes.

These syringes and needles are disposable or "single use" only. **THEY SHOULD NOT BE REUSED!** After injecting your pet with insulin, place the needle and the needle guard in a suitable disposal container. **Do Not** recap the needle, you could inadvertently stick the needle into your hand or finger.

Drawing Up the Insulin

1. Set out the syringe and needle, insulin bottle and have your pet ready.
2. Remove the needle guard from the needle; draw back the plunger to the desired dose level.
3. Insert the needle into the insulin bottle.
4. Inject the air in the syringe into the bottle to prevent a vacuum from forming in the insulin bottle.
5. Pull back on the plunger, filling the syringe with insulin to the correct level.
6. Before withdrawing the needle from the bottle check to see that there are no air bubbles in the syringe. If you see an air bubble, draw up slightly more insulin into the syringe and gently tap the barrel with your finger to move the air bubble to the nozzle of the syringe, then gently expel the bubble by pushing the plunger upwards towards the bottle.
7. Now check to see that you have the correct amount of insulin in the syringe. The correct dose of insulin is measured from the needle end, or "0" on the syringe barrel, to the end of the plunger closest to the needle.

How to Give an Insulin Injection

"Sterilizing" the skin with alcohol is not necessary and may be counterproductive if it stings and causes your pet to avoid the injections.

1. Hold the syringe in your right hand (or your left, if left-handed). There are many ways to hold the syringe. With time you will develop the one easiest for you. You may find it helpful to begin practicing with a syringe filled with water and injecting it into an orange.
2. Have a friend or member of your family hold your pet as you pick up a fold of skin along the back with your free hand. Be sure to pick a different spot for each injection. **Insulin injections should not be given between the shoulder blades because insulin absorption is erratic or unpredictable in this area.**
3. Push the very sharp, very thin needle through the animal's skin quickly. This should be easy and painless using the insulin needle. Take care to push the needle through only one fold of the skin, not into your finger, your pet's underlying muscle or through both layers of skin.
4. Pull back gently on the plunger (aspirate) to make sure that no blood fills the syringe. If this happens, remove the syringe from this site, and proceed in another location. You may have just hit a skin blood vessel.
5. With your thumb on the plunger, push the plunger further into the syringe until it will not go in any farther.
6. Withdraw the needle from the pet's skin and immediately dispose of the syringe and needle guard.
7. Pat your pet to reward it for sitting quietly for the injection.

Feeding

Regulation is achieved via a balance of diet, exercise, and insulin. Realizing that therapeutic diets are not always attractive to pets, there are some ideal foods which should at least be offered.

The most up-to-date choice for cats is a low carbohydrate high protein diet. These diets promote weight loss in obese diabetics and are available in both canned and dry formulations. For dogs, high fiber diets are still in favor

as fiber seems to help sensitize the pet to insulin. Talk to your veterinarian to select an appropriate choice for your pet.

Avoid soft-moist diets as sugars are used as preservatives. Avoid breads and sweet treats. If it is not possible to change the pet's diet, then regulation will just have to be worked out around whatever the pet will eat.

When you feed your pet is as important as what you feed your pet. Your pet must be fed the recommended diet in the correct quantity at a regular time each day in conjunction with the insulin injection. Correct dietary management is a critical part of the successful management of the diabetic animal. As a general rule of thumb, the diabetic animal should be fed two to three times daily. Ensure that your pet is eating well before giving each insulin injection. If the insulin is given first and the animal refuses to eat, this could lead to hypoglycemia. Cats that are fed free-choice (i.e., food available all time) require no changes in their lifestyle as long as you are certain that they are eating normally.

Exercise

If your pet is overweight, weight reduction is essential. Obesity decreases the body's tissue responsiveness to insulin (both natural and injected) and can cause dangerous increases in blood sugar levels. Follow the diet program laid out by your veterinarian. Changes in weight will affect the insulin dose that is required.

There are no restrictions on your pet's normal activity. However, it is important that your pet's exercise be moderately regulated and consistent in order to keep the insulin needs as consistent as possible. Dogs undergoing periods of extreme activity (i.e., hunting dogs, herding dogs) will require a slightly lower dose of insulin during periods of extreme activity.

Home Monitoring

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

First, you need to be constantly aware of your pet'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 pet 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.

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

Home Testing

Not every pet is amenable to getting pricked with a lancet so that a drop of blood can be harvested for testing. We do not want your pet to fear interaction with you and do not want you to get bitten or scratched; still, some pets are comfortable with periodic glucose monitoring at home. Home testing may work best for pets that become so agitated by going to the vet that their blood sugar levels are altered at the office and cannot be interpreted. Further, a pet owner can save a great deal of money if they can produce their own glucose curve at home when the veterinarian requests one.

Human glucose meters can be obtained from any drugstore but ideally the AlphaTrak glucometer should be used as it is designed for pets. The AlphaTrak is more accurate in cats and dogs than the human equipment, although certainly the human equipment was all that was available for decades and worked sufficiently. If you would like to get an AlphaTrak meter, contact your veterinarian.

If you choose to use a glucometer at home, be sure to keep a log of when your pet was fed, when insulin was given, and what the glucose levels were that you found. Bring this log to your veterinarian when you come for checkups. Glucose levels obtained prior to the first insulin administration of the day are particularly useful.

If your pet is too sensitive for a valid glucose curve at the vet's office and you do not think you are up to blood sugar testing at home, the fructosamine blood test may be particularly useful. Again, this test looks at average glucose levels so wide fluctuations will not be discovered but at least there is a monitoring option for this situation.

Ketostix are used to detect ketones in urine and can be obtained at any drug store. If it is not difficult to access your pet's urine, a first morning test is helpful. Remember, finding ketones occasionally is not a problem but a positive dipstick three days in a row is a criterion for a vet visit.

When to Return to the Vet

Your pet will probably require re-regulation at some point. During re-regulation periods, expect a curve to be run a week or two after each adjustment in insulin dose.

Bring your pet in for a re-check exam and glucose curve if your pet:

- seems to feel ill
- has lost weight
- has a ravenous appetite or loses its appetite
- seems to be drinking or urinating excessively
- becomes disoriented or groggy
- has ketones in the urine for three days in a row

Hypoglycemia (Low Blood Sugar)

What is Hypoglycemia?

In pets with diabetes mellitus, hypoglycemia is the condition of having a glucose (blood sugar) level that is too low to effectively fuel the body's blood cells. Hypoglycemia most often results from accidental overdose of insulin, but it can also occur if a pet is not eating well, misses a meal or vomits after eating, or if the type and amount of food he is being fed changes. Hypoglycemia may become a problem with very vigorous exercise; for this reason, regular daily controlled exercise is best.

Hypoglycemia can also result if the body's need for insulin changes. This scenario is particularly common in cats who often return to a non-diabetic state once an appropriate diet and insulin therapy start.

Vet Tips

Avoid "double-dosing" insulin. Only one person in a household should have the responsibility of giving insulin. A daily log should be kept of the time/amount of food and insulin that is given to avoid errors.

Proper daily monitoring of blood and/or urine glucose can help identify changing insulin needs in order to avoid a hypoglycemic crisis.

Signs of Hypoglycemia

The signs of hypoglycemia may occur suddenly and include:

- Lethargy or dullness
- Restlessness, anxiety or other behavioral changes
- Weakness, difficulty standing or a staggering gait
- Muscle twitching
- Seizures
- Coma
- Death

First Steps at Home

If your pet is showing signs of hypoglycemia and is able to eat, feed him a meal. If he is not alert, hand-feed him corn syrup or honey until he is alert enough to eat his normal food. At that time, feed a meal of his normal food.

If your pet is unconscious, rub a tablespoon of corn syrup or honey on his gums. If he regains consciousness, feed him and get him to your veterinarian for continued observation. If he remains unconscious, this is a medical emergency and you should seek veterinary help immediately!

Vet Tips

Always have corn syrup or honey in your home and in your first-aid kit/car in order to be prepared for hypoglycemic emergencies.

You should not give another dosage of insulin after any hypoglycemic episode until you have spoken to your veterinarian.

At the Hospital

Hypoglycemia is a life-threatening emergency. When you get to the vet's office, your pet's blood glucose will immediately be checked to determine if intravenous sugar solutions are necessary or if he is stable enough to be managed by withholding insulin and giving food.

If an insulin overdose or missed meal is not to blame for your pet's hypoglycemia, your veterinarian will need a complete history from you and will perform a full examination to determine how to adjust his insulin in order to prevent a future hypoglycemic crisis.

Most often, dogs and cats will recover from hypoglycemic episodes; however, these episodes can be life-threatening and should be treated as emergencies.

Cats and Hypoglycemia

Cats are unique in that many revert to a non-diabetic state (called diabetic remission) within the first four months of beginning appropriate diet and insulin treatment for diabetes. When remission occurs, a cat becomes non-diabetic and no longer requires insulin therapy. If an owner is not monitoring blood or urine glucose levels routinely, diabetic remission can go unnoticed, and if insulin injections are continued, hypoglycemia may occur.

Other Diabetic Emergencies

Although less critical than hypoglycemia, other symptoms that could indicate an impending emergency include:

Complete loss of appetite or an appetite that is decreased for several days

Vomiting or diarrhea

Straining to urinate or blood in the urine, which could indicate urinary tract infection

Ketones detected on routine at-home urine testing

It is always best to contact your veterinarian if you are concerned about any changes in your diabetic pet. Make sure to see your veterinarian regularly even if your pet's diabetes is stable, and make sure you have a plan for how to handle any after-hours emergencies.