

# Diabetes Mellitus

## ABOUT THE DIAGNOSIS

**CAUSE:** The pancreas is an organ within the belly (abdomen). The two main functions of the pancreas are to produce enzymes that are involved with digestion and hormones that are primarily involved with the utilization and metabolism of sugar (glucose). Insulin is one of the most important of these hormones.

Diabetes mellitus (DM), generally just called diabetes, is a disease that affects dogs and cats. Diabetes mellitus is caused by a deficiency of insulin that results in the inability of the body's tissues and organs to properly utilize glucose. When glucose is not used properly by the body, high blood sugar levels develop. This is exactly like diabetes mellitus in human beings.

There are two types of diabetes mellitus. Type I (also called insulin-dependent diabetes mellitus, or in humans, juvenile diabetes) occurs when the pancreas does not produce enough insulin. Type II (non-insulin-dependent diabetes mellitus) occurs when the body's ability to utilize insulin that is produced is abnormal. Almost all dogs with diabetes mellitus have type I, whereas 50–70% of cats diagnosed with diabetes mellitus have type I and the remaining 30–50% have type II. In dogs, diabetes mellitus is commonly a permanent disorder, whereas in cats a short-term (transient) and reversible form of diabetes mellitus exists. In human beings, by contrast, type II diabetes is more common than type I (juvenile) diabetes.

Diabetes mellitus is one of the most common endocrine (hormonal) disorders in cats and dogs. Diabetes mellitus usually affects middle-aged to older cats and dogs. Any breed can be affected; however in dogs, the keeshond, puli, miniature pinscher, Cairn terrier, poodle, dachshund, miniature schnauzer, and beagle are breeds with higher risks. In dogs, females are more commonly affected, whereas in cats, males are more commonly affected.

The causes of diabetes mellitus can include a genetic susceptibility, infectious diseases, immune system abnormalities that cause destruction of the hormone-producing regions in the pancreas, pancreatitis (inflammation of the pancreas), medications (corticosteroids, progestins), as well as other hormonal diseases (hyperadrenocorticism, acromegaly). Other risk factors include animals that are overweight and female dogs that have not been altered (spayed).

Diabetic animals are more prone to developing bacterial and fungal infections (opportunistic infections). Urinary tract infections are very common, as sugars present in the urine of diabetic patients can allow bacteria to multiply.

Most diabetic dogs and cat have mild or moderate symptoms. At the far end of the spectrum, however, ketoacidosis is the most serious complication of diabetes mellitus and is considered a medical emergency. Uncontrolled, ketoacidosis produces diabetic coma and may be fatal. Animals with diabetic ketoacidosis are most often lethargic (sluggish), have little or no appetite, and generally seem profoundly ill; diagnostic testing by a veterinarian is necessary to identify ketoacidosis, and intensive care treatment is generally necessary for animals with diabetic ketoacidosis.

**DIAGNOSIS:** Symptoms of diabetes mellitus can vary from patient to patient and are often common to several other diseases. The most common early signs of diabetes mellitus include an increase in thirst and urination, weight loss, and an increase in appetite. Later in the course of the disease, sluggishness and vomiting can be noted. Dogs can also develop poor vision and a

white or cloudy discoloration of the eyes, whereas cats can develop a poor hair coat, yellow discolorations to the skin, gums, and whites of the eyes (icterus/jaundice), and hindlimb weakness with an abnormal flat stance (diabetic neuropathy).

Your veterinarian will begin by asking you several questions to try to determine if diabetes mellitus, or another type of problem altogether, could be responsible for symptoms. You should provide whatever information you have when you answer these questions, which often include: the type of symptoms observed, the length of time they have been occurring, effects on vital functions such as appetite and urine elimination, current diet, and any current medications or supplements you are giving your pet.

When examining your pet, your veterinarian will look for some of the abnormalities that can occur with diabetes mellitus, which include obesity/overweight, dehydration, jaundice, and a liver that can be felt by the fingertips to be enlarged (seen commonly in dogs and cats as a result of abnormal fat accumulation within the liver as the body tries to compensate for abnormal glucose utilization), cataract formation (seen commonly in dogs as a result of abnormal accumulation of sugars within certain structures of the eye), oily haircoat with dandruff, and diabetic neuropathy (seen occasionally in cats). If diabetes mellitus is suspected by your veterinarian, further testing will be recommended.

Routine lab tests consisting of blood and urine tests are typically recommended in order to diagnose diabetes mellitus as well as rule out other possible medical problems that produce similar symptoms. A blood sugar level and urinalysis are the tests of choice. Finding persistently high levels of glucose in the blood (hyperglycemia) and urine (glucosuria) in a fasted (no intake of food for 8 or more hours) animal is typically diagnostic for diabetes mellitus. It is important to keep in mind, however, that healthy cats can have high levels of glucose in the blood as a result of anxiety from the visit to the veterinary hospital, not just from diabetes. In some of these cases, small amounts of glucose can also be seen in the urine, making a diagnosis of diabetes mellitus more difficult in some cats. Repeatedly high blood and urine glucose levels and the measurement of glycated hemoglobin, or fructosamine, levels can help your veterinarian diagnose true diabetes mellitus versus anxiety-related hyperglycemia in your cat. These tests give a better indication of what the blood sugar levels have been in the animal over the previous several weeks and are less affected by short periods of stress such as travel to the veterinary clinic.

A complete blood count (CBC), biochemical profile, urine culture and sensitivity, imaging techniques (x-rays and ultrasound), and tests for other hormonal problems are also commonly performed to identify other concurrent illnesses and underlying diseases.

The diagnosis of diabetes mellitus, and its treatment, can be complex and challenging. No two individuals are alike with this disease. If there are questions, or simply for a second opinion, your veterinarian may refer you to a veterinary internal medicine specialist for a second opinion (directory: [www.acvim.org](http://www.acvim.org) for North America, [www.ecvim-ca.org](http://www.ecvim-ca.org) for Europe).

## LIVING WITH THE DIAGNOSIS

Diabetes mellitus can be a serious and life-threatening disease if left untreated. On the other hand, most diabetic animals that are diagnosed and treated properly and that respond well to treatment can live a normal or near-normal life span with a good quality of

life. Managing a diabetic animal requires a great commitment of time, education, observation, and follow-up care.

The most important factor in a diabetic animal's life is routine. Ideally meals and treatments are given as close to the same time as possible each day. Strenuous exercise generally should be avoided. A consistent amount of controlled exercise each day is ideal for dogs, provided this is tolerated by the dog and the level is tailored to remain comfortable for your pet and for you. As in diabetic people, a good daily routine of eating and exercising for diabetic pets will help prevent irregular fluctuations in blood sugar levels.

Give all prescribed medications as directed by your veterinarian. These medications are essential in regulating blood sugar levels as well as improving the quality of your pet's life. Most of these medications will be required for the rest of your pet's life. Some cats can go through periods of time where they no longer require medication for diabetes mellitus, called the diabetic honeymoon period. In a few of these cases, cats will never require medication again, whereas in most cases, symptoms will develop again at a later time and require further treatment. Discuss with your veterinarian all of the possible side effects of any medications prescribed for your pet, as well as the appropriate actions to take if you notice any new or recurrent symptoms.

If your pet requires insulin injections, it is very important to become familiar with the proper handling, administration, and disposal of insulin. Your veterinarian will be able to give you detailed instructions. Insulin is a fragile substance and must be kept in a cool dry place (refrigerator). The insulin bottle should be mixed carefully and thoroughly before drawing up the insulin dose. Ideally the bottle is rolled gently in the hands until thorough mixing is achieved, and the bottle should never be shaken since this can damage and inactivate the insulin. You should be aware of the type and source of insulin and insulin syringes your pet was prescribed, so that when you need a refill, you are able to ensure that you have received the proper medication and syringe size (insulin and syringes both come in a variety of types). Insulin needles and syringes should never be reused or disposed of in the trash. Rather, collect them in a puncture-proof container (e.g., empty bleach jug) and bring it to your veterinarian for disposal according to state/provincial/local laws on medical waste.

You should discuss an ideal diet for your pet with your veterinarian and feed only the recommended foods. Some prescription pet diets are made especially for diabetic patients and should be used if your pet enjoys the taste of them because they can improve an animal's diabetic control. If your pet is no longer willing to eat a prescription diet, contact your veterinarian prior to changing foods. Consistent nutrition is extremely important in the regulation of a diabetic patient. Always provide unlimited access to fresh clean water. It is also important to talk to your veterinarian about any changes that should be made to your pet's medications if he/she is unwilling to eat or if digestive problems such as vomiting occur.

During the first few months after an animal is diagnosed with diabetes mellitus, several trips to the veterinarian will be required for rechecks and tailoring of the treatment. In most situations, you will need to give daily injections of a low dose of insulin at home, and the dose is gradually increased by your veterinarian based on rechecks until the original symptoms are gone (i.e., the diabetes is well-controlled). Blood sugar levels are measured every hour or two for a 12- or 24-hour period 1 to 2 weeks after starting the insulin (the first recheck visit) and periodically thereafter to ensure that appropriate glucose levels are seen. This helps prevent overdosing your pet and allows for fine-tuning of the insulin dose. It is common initially for blood glucose levels to be checked by your veterinarian every 1 to 2 weeks. To do this, your pet generally will

have to stay in the hospital for the day in order to monitor blood glucose levels every few hours. Once the diabetes is well regulated, these visits will be less frequent, but some degree of monitoring is still required (a few times per year) since insulin requirements can change with time. It is very important to carefully note any changes in your pet's weight, drinking, urination, and eating habits between appointments. Measuring the amount of water your animal drinks in a day can be very useful. This information can help your veterinarian make appropriate adjustments in your pet's medications, especially insulin. Keeping a daily diary of your observations and of the dosage and timing of insulin injections is very helpful and can also help you keep track of medications.

Once your pet has started any treatment for diabetes mellitus, monitoring for signs of low sugar levels (hypoglycemia) is also very important. Too much insulin can cause blood sugar levels to go too low. Low sugar levels can cause disorientation, sluggishness, seizures, coma, and even death if prolonged. If you notice that your pet seems disorientated or weak but is still responsive, offer food immediately. If your pet is unconscious (cannot be awoken despite loud calling and shaking), apply a sugary solution like corn syrup or maple syrup to the gums. In both of these cases, contact your veterinarian or local emergency hospital immediately.

## TREATMENT

The goal of treating a diabetic animal is to minimize blood glucose fluctuations, eliminate the symptoms associated with high blood glucose levels (excessive drinking, urination, and appetite), and improve the quality of the pet's life.

Treatment of diabetes mellitus must be based on the individual patient, the severity of the symptoms, the underlying cause, the type of diabetes, and the secondary diseases that may be involved. In every patient, however, all medications that can precipitate diabetes mellitus should be identified and discontinued (steroids, progestins), and all concurrent or underlying diseases should be diagnosed and treated. Intact females (dogs or cats that have not been altered/spayed) should be spayed. Hormonal changes that occur when animals are in heat can alter the effects of insulin and the body's use of glucose.

Patients with severe symptoms of diabetes mellitus or ketoacidosis will likely need to be hospitalized initially while intravenous (IV) fluids are given to correct dehydration, electrolyte, and acid-base abnormalities and medications including insulin are initiated. If hospitalization is not required, your veterinarian will start your pet on medications and treatments that can be given at home. Ketoacidosis and severe symptoms (such as loss of appetite, vomiting, and collapse) is a very serious combination that carries a guarded prognosis; one third of patients do not survive even with intensive care.

Insulin treatment is required in all dogs and most cats. Insulin is a very fragile hormone that can easily be inactivated. This is why insulin is given as an injection under the skin with a small needle. There are several different types and sources of insulin. They vary in strength and length (duration) of effect. Your veterinarian will recommend the most appropriate insulin for your animal. Most animals require two insulin injections daily, given approximately 12 hours apart with a meal. Most owners become very efficient at giving these injections and most pets become very tolerant of the treatments. Type I diabetes typically requires lifelong insulin injections.

A diet and weight management program is essential to proper treatment of diabetes mellitus. Diets that are high in simple carbohydrates (sugars), which can cause a spike in blood sugar levels, are avoided. Diets containing complex carbohydrates (starches) that are broken down and used by the body more slowly are

preferable, in moderation. Fiber is an important ingredient in diabetic diets since it slows the absorption of carbohydrates in the body and can decrease hunger sensations for those animals that are overweight. There are several different commercial prescription diets available that can meet the needs of all diabetic patients, whether weight loss, maintenance, or gain is the goal. Achieving and maintaining an ideal body weight is helpful in the treatment of both type I and type II diabetes mellitus.

Some cats with type II diabetes mellitus can be managed with diet therapy and medication given by mouth rather than insulin injections. Only a very small minority of diabetic animals will respond well to these medications. Your veterinarian will help you decide if this is a good alternative for your pet.

Cataracts (cloudy eyes with poor vision to blindness) that develop in dogs as a result of diabetes mellitus will not resolve once the diabetes mellitus is regulated. There is a surgery that can remove the cloudy portion of the eye and restore vision. This type of surgery is generally performed by a veterinary ophthalmologist (see [www.acvo.com](http://www.acvo.com) for a listing of veterinarians specialized exclusively in eye problems of animals).

## DOs

- Realize that diabetes mellitus is a very treatable disease but that the proper management of a diabetic animal requires significant commitment of time, finances, and attention.
- Realize that serious and life-threatening complications can arise, especially if diabetes mellitus is left untreated or is treated inappropriately.
- Offer food immediately if you notice that your diabetic pet who is receiving insulin seems disoriented but is still alert and responsive. If your diabetic pet who is receiving insulin appears unconscious, apply a sugary solution like corn syrup or maple syrup to the gums. In either of these cases, contact your veterinarian or local emergency hospital immediately.
- Keep all recommended follow-up appointments with your veterinarian since they are essential in keeping your pet's blood sugar levels well regulated.
- Have your veterinarian or veterinary technician show you how to give all medications and demonstrate the correct method for insulin handling, administration, and disposal.
- Handle and give all medications exactly as directed by your veterinarian. If you feel your pet is having side effects from any medications or you are finding it very difficult to medicate your animal, contact your veterinarian for advice before discontinuing the treatment.
- Ask your veterinarian questions about information you do not understand.
- Understand that in some dogs and cats, diabetes mellitus can be difficult to treat, and a second opinion from a veterinary internal medicine specialist may be helpful. You can discuss this with your veterinarian and a list of these specialists is available at [www.acvim.org](http://www.acvim.org) for North America, [www.ecvim-ca.org](http://www.ecvim-ca.org) for Europe.

## DON'Ts

- Do not postpone a visit to your veterinarian if you observe any symptoms of illness or of diabetes mellitus since early diagnosis and treatment can aid in preventing serious and life-threatening complications of the disease and improving the quality of your pet's life. The initial screening may only require a physical exam and routine blood and urine tests.
- Do not give any medications that are not prescribed by your veterinarian for the specific animal in question.

- Do not stop any medications if your animal is feeling better without consulting with your veterinarian first.
- Do not assume that all sources of information are accurate or complete (i.e., Internet sites, outdated pamphlets or books, pet store workers, friends, etc.). Ask your veterinarian for recommended sources of information.
- If you are giving insulin injections at home, do not reuse or dispose of needles or syringes in the trash. Rather, collect them in a puncture-proof container (e.g., empty bleach jug) and bring it to your veterinarian for disposal.

## WHEN TO CALL YOUR VETERINARIAN

- If your pet's symptoms change, worsen, or any new problems arise.
- If you are unable to give medications as prescribed or if you require a prescription refill.
- When you have any questions or concerns related to your pet's continual treatment plan or current status.

## SIGNS TO WATCH FOR

Symptoms that could indicate poor diabetic control or an additional medical problem, meaning a recheck visit to the veterinarian should be made promptly:

- Watch for general sign of illness, which can include changes in appetite, weight loss, decrease in activity, sluggishness, dull or poorly kept coat, and changes in behavior such as hiding and aggressiveness.
- Watch for signs of diabetes mellitus, which can include an increase in thirst (Are you filling up the water bowls more often? Is your animal drinking water from taps, bath tubs, fountains, etc.?) and urination (Is your animal asking to go outside more frequently or having accidents in the house? Do you notice larger urine spots in the litter box, or do you have to change the box more frequently than usual?), vomiting, weakness, changes in vision and appearance of the eyes, yellow discolorations to the skin, gums, and whites of the eyes, and hindlimb weakness with an abnormal flat stance.

## ROUTINE FOLLOW-UP

- As insulin requirements of a diabetic dog or cat can change over time, it is very important to keep all recommended follow-up appointments and lab tests with your veterinarian in order to monitor blood sugar levels, document and treat any new problems that may arise, and make any needed medication adjustments.

*Other information that may be useful: "How-To" Client Education Sheets:*

- How to Handle and Administer Insulin
- How to Monitor Blood Glucose Levels at Home

Practice Stamp or Name & Address