

Diabetes Mellitus (Cats)

ABOUT THE DIAGNOSIS

Cause: Diabetes mellitus (DM), often simply called diabetes or sometimes “sugar diabetes”, is a disease that affects cats and dogs, just as it affects people. In DM, the body fails to metabolize glucose (a form of sugar) correctly, leading to both high blood glucose concentrations at the same time the body’s cells are starving for the energy contained in the glucose. There are several hormones that help regulate blood sugar, but key among these is the hormone insulin. In DM, there is either inadequate production of insulin (made in the pancreas, an organ in the abdomen) or there is inadequate use of insulin at the level of the cells in the body’s tissues.

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 insulin. Type II (non-insulin-dependent diabetes mellitus) occurs when the body cannot utilize insulin as normal. Cats can get either type of DM – a failure to produce insulin, or a failure to use insulin. If a cat with a failure to use insulin receives appropriate treatment, he or she can go into a remission of DM. However, such cats are susceptible to developing disease again later, and can even convert to the irreversible form in which no insulin is produced (Type I). Diabetes mellitus is one of the most common endocrine (hormonal) disorders of cats. Diabetes mellitus usually affects middle-aged to older cats. Any breed can be affected, with males slightly more often affected than females. Overweight or obese cats are more likely to develop DM than lean cats, although DM will cause weight loss once it develops. Usually, the trigger for DM is undetermined. We do know that genetic factors, medications, recurrent bouts of pancreatitis, or other endocrine (hormone) disorders can cause DM.

Diagnosis: The signs of DM vary from cat to cat. Early on, you might notice that you have to fill the water bowl more often or that the litter box is heavier with urine as the cat drinks more water and urinates more often. Weight loss occurs as sugar is lost in the urine instead of being used by the body’s cells. Over time, the cat might walk with the hocks (heels) dropped toward the floor as a result of diabetic neuropathy. The most serious complication of DM is ketoacidosis, which 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 necessary for animals with diabetic ketoacidosis.

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 cat.

When examining your cat, 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 (occurring as a result of abnormal fat accumulation within the liver as the body tries to compensate for abnormal glucose utilization), oily haircoat with dandruff, and diabetic neuropathy.

Routine lab tests consisting of blood and urine tests are recommended in order to diagnose DM as well as rule out other possible medical problems that produce similar symptoms. A blood sugar (glucose) level and urinalysis are the first 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 DM. 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. If the glucose value in the blood and urine is only moderately high, it may be necessary to repeat the testing, or to measure glycated hemoglobin or fructosamine levels. 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. Urinary tract infections are common in diabetic animals and can impact disease treatment.

The diagnosis of DM, and its treatment, can be complex and challenging. No two individuals with this disease are alike. 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 or www.vetspecialists.com for North America; www.ecvim-ca.org for Europe).

LIVING WITH THE DIAGNOSIS

Diabetes mellitus is a serious and life-threatening disease if left untreated. On the other hand, most diabetic cats that are diagnosed and treated properly will 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 (usually, insulin injections) are given as close to the same time as possible each day. 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 cat’s life. Some cats can go through periods of time where they no longer require medication for diabetes mellitus, called the diabetic honeymoon period or remission. In a few of these cases, cats will never require antidiabetic medication like insulin again, whereas in most cases, symptoms will develop again at a later time and require further treatment.

Many pet owners are anxious about the need to inject insulin. However, most pets are not bothered by the injections in the least, and with a little practice, it is not difficult. You may know people that receive pills for treatment of DM; oral antidiabetic medications are not a good option for most cats. While they may help some cats with abnormal insulin utilization in the short run, those cats will not enter a remission and eventually will simply not make enough insulin at all. Therefore, if at all possible it is best to begin treatment with insulin injections. It is very important to become familiar with the proper handling, administration, and disposal of insulin. There are not only multiple types of insulin, but multiple types of insulin syringe—it is important that you know which type your cat receives, and you use the correct syringe. You will want to check each time

you receive a refill that both the insulin, and the insulin syringes, are the correct type for your cat. If you have trouble using the syringe, or your vision makes it difficult to read the small numbers on the syringe to give the tiny volume of insulin your cat is likely to require, you can discuss the use of an “insulin pen”. These devices allow you to “dial in” the dose needed rather than drawing it up out of a vial. You then deliver the dose to your cat by holding the pen against the skin and pushing a button.

Your veterinarian will be able to give you detailed instructions on how to store, handle, and administer insulin. Different types of insulin have different handling instructions, but it is important that it be kept in a cool dry place (refrigerator is usually ideal). For most types of insulin, the 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. On the other hand, other types of insulin (e.g., Vetsulin, Caninsulin) must be shaken to form a milky suspension. After you give the insulin, the needle and syringe should be disposed of and not reused. You can 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. For cats, canned foods are recommended over dry. Some prescription pet diets are made especially for diabetic patients and should be used if your cat enjoys the taste of them because they can improve an animal’s diabetic control. If your cat is no longer willing to eat a prescription diet, contact your veterinarian prior to changing foods about other options. Portioned meal feeding has advantages over allowing the cat to eat whenever they like, including the ability to recognize quickly if your cat is not eating as he or she should. Usually, two meals a day are fed, each one at about the time of insulin administration. For cats that have always had dry food available at all times, the transition can be easy or difficult, but your veterinarian can discuss strategies to make the change. Always provide unlimited access to fresh clean water to drink. 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. In many cases, the insulin dose may be halved or skipped entirely if the cat misses one of the major meals.

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, your cat will begin with a low dose of insulin that might need to be gradually increased by your veterinarian based on rechecks until diabetes is well-controlled. Often, your veterinarian will perform a “blood glucose curve” to make a graph of what happens to glucose levels during the day after insulin administration. 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 giving too much insulin to your pet and causing dangerously low blood sugar levels, and it 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 cat 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. Some cat owners choose to learn to measure blood glucose at home so that they can perform the curve themselves with less stress for the cat, then sharing the information with their veterinarian for interpretation. Other times, veterinarians may ask the cat owner to check urine

glucose at home. The point of assessing urine for glucose is not to increase the insulin dose if urine glucose is present, but to consider reducing the dose if urine glucose is consistently absent. That is because an absence of glucose in the urine might indicate that your cat has entered remission and it may not need insulin, at least for now. It also is very important to carefully note any changes in your cat’s weight, drinking, urination, and eating habits between appointments. 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. When there is more than one adult in the family, it is not unheard of for a pet to be accidentally overdosed when two members of the family each give insulin, not realizing that a dose was already administered.

Once your pet has started any treatment for DM, monitoring for signs of low sugar levels (hypoglycemia) is 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 tasty 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 veterinary 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 DM 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.

Patients with severe symptoms of DM 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. 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.

Luckily, most diabetic cats do not have ketoacidosis; therefore, they do have a good prognosis (outlook) and are likely to do well provided that the cat’s owner is willing to invest the time and effort required to manage the disease. You will probably be administering insulin injections twice daily, meaning approximately every 12 hours. The types of insulin recommended depends on a number of factors, and you might end up changing insulin types during your cat’s lifetime based on response to treatment. Comparison of the insulin types you are most likely to use are given below.

Insulin Type	Syringe Type	Veterinary Product	Comments
Glargine	U-100	no	A preferred insulin for cats
PZI	U-40	yes	A preferred insulin for cats
Lente	U-40	yes	Sometimes used in cats
NPH	U-100	no	Rarely recommended for cats
Detemir	U-100	no	Rarely recommended for cats

The best chance for a cat with DM to go into a remission is intensive early treatment with insulin and appropriate dietary management. Owners must be very vigilant for signs of weakness, lethargy, or disorientation that might indicate hypoglycemia. This can occur when the owner has given insulin but the pet is in a

diabetic remission and no longer needs treatment. Although 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.

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.
- Have your veterinarian or veterinary technician show you how to give all medications and demonstrate the correct method for insulin handling, administration, and disposal.
- Double check the insulin and syringe type each time you get a refill.
- Ask your veterinarian how long you can use the same bottle.
 - Many of the human insulin types (e.g., glargine) are expensive, and they are sold in bottles meant for an adult human. That means that the bottle might still have insulin inside long after it should be discarded, so you might need to replace the bottle before it is empty.
 - On the other hand, manufacturers recommend that some of these same insulin types be discarded after only 28 days when used in humans. As long as they have been stored and handled appropriately, it is safe to keep them for longer (usually up to 6 months).
- Handle and use insulin as directed
 - Wipe the stopper of the insulin vial with alcohol, then let it dry before use.
 - Either roll or shake the insulin to create a suspension (depending on insulin type).
 - Keep the insulin cool and dry (refrigerator is ideal); never freeze, and never allow it to sit in the sun or in a hot car.
 - Check that the insulin is not discolored and does not contain “chunks” after rolling/shaking that might indicate it has been contaminated and needs to be replaced.
- Realize that serious and life-threatening complications can arise either from not enough insulin or from too much insulin.
- 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 veterinary hospital immediately.

- Keep all recommended follow-up appointments with your veterinarian since they are essential in keeping your cat's blood sugar levels well regulated.
- 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.
- Ask if some form of at-home glucose monitoring, either blood or urine, is right for your cat.
- Understand that in some 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 or www.vetspecialists.com for North America; www.ecvim-ca.org for Europe.

DON'Ts

- Do not postpone a visit to your veterinarian if you observe any symptoms of illness 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 for DM 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.
- Never increase the insulin dosage without discussing with your veterinarian. Your veterinarian might provide you with instructions for lowering the insulin dose if your cat misses a meal, but if more than 2 meals are missed you should seek veterinary care.
- 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 needles or syringes, and do not dispose of them in the trash.

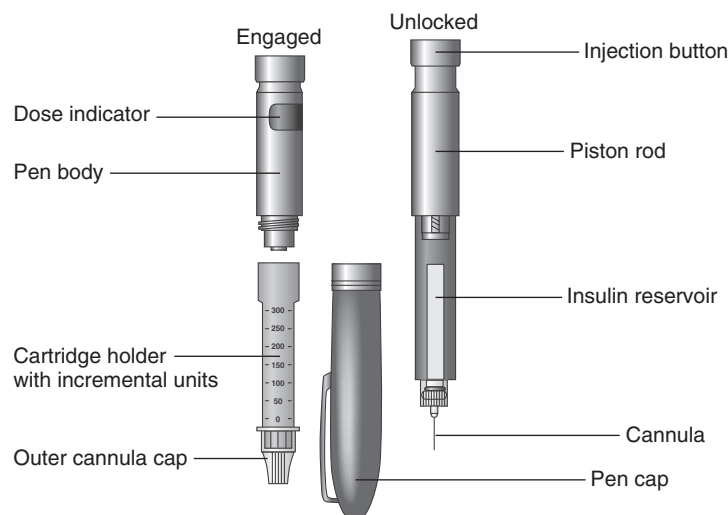


Diagram of typical insulin pen components. (Adapted from Gesenhues S, Ziesché R (eds): Praxisleitfaden Allgemeinmedizin. Berlin: Urban & Fischer, Elsevier, 2010. Fig 17-3.)

WHEN TO CALL YOUR VETERINARIAN

- If your cat's symptoms change, worsen, or any new problems arise
- If your cat refuses food for more than 2 meals or 1 day
- 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 signs 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, bathtubs, fountains, etc.?) and urination (Do you notice larger urine spots in the litter box, or do you have to change the box more frequently than usual?), vomiting, weakness, 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 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 Administer and Handle Insulin
- How to Monitor Blood Glucose Levels at Home



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