

Diabetes Mellitus

About Diabetes Mellitus

Diabetes mellitus is an extremely common condition in cats, people and various other species – it can affect dogs, rodents, birds and many more. There are three different forms of diabetes that are commonly discussed in people: type I, type II and type III (pregnancy) diabetes. Of these, it is the first two categories that apply to our pets, and these conditions are described in more detail below.

Diabetes is a condition that affects the body's ability to store glucose, which is the basic energy unit that all of our cells use to survive. Normally after we eat a meal, our digestive system breaks the foods down into their most basic units, including glucose. The pancreas releases insulin in response to the sudden increase in blood glucose levels, which causes the glucose to be taken out of the blood and stored in the liver for later use. When our blood sugar level falls too low again, the stored glucose is slowly released.

Patients with diabetes mellitus have a problem with producing or regulating insulin. This means that despite a very high blood glucose level (known as hyperglycaemia), the body is unable to take the glucose out of the blood and store it for later use. A high level of circulating blood glucose is very dangerous; however, the more dangerous aspect of diabetes is that of a low circulating blood glucose.

As previously stated, blood sugar levels rise after a meal, but they also fall as the cells in the body use the available glucose and the liver then releases stored glucose to sustain the body until the next meal. In cases of diabetes where sugars cannot be removed from the blood, the liver runs out of stored glucose (glycogen) very quickly so there is very little energy held in reserve. When the blood sugar level runs low after sugars from a meal have been used up, there is therefore nothing to replace the sugar with except another meal. In the absence of food, this condition is rapidly life-threatening – if the brain or any of the vital organs run out of energy, life cannot be sustained.

Type I Diabetes Mellitus

This is the most common form of diabetes in cats but can also be diagnosed in dogs, particularly in breeds that are predisposed. Type I diabetes may be caused by amyloidosis, which is a deposit of proteins around the cells of the pancreas (as well as in other places) that forms a barrier. In this way, although the body can produce insulin, the hormone produced is unable to get past the protein barrier so very little or no insulin is released, causing diabetes. Alternatively, the pancreatic cells responsible for insulin production may actually be destroyed by the body, again resulting in an inability to produce insulin and clinical diabetes mellitus.

Type I diabetes mellitus is often diagnosed earlier in life than type II diabetes mellitus and cannot be rectified by diet. Its management relies on replacement of natural (endogenous) insulin with injected insulin.

Type II Diabetes Mellitus

Type II diabetes used to be a condition rarely diagnosed in the veterinary industry, although it is the more common type in dogs. However, with the sudden and alarming rise in obesity amongst pet populations, this has become the most common cause of diabetes across all species and is directly linked to diet and poor exercise.

Type II diabetes does not involve a change in the production or release of insulin but is caused by a change in sensitivity of the body's receptors for insulin. When the body is constantly subjected to

elevated blood glucose concentrations, as is the case in overweight pets, insulin is released constantly in an attempt to regulate the circulating sugar levels. However, this response cannot be sustained long-term. In addition, overweight pets are less likely to be experiencing rigorous exercise on a regular basis.

Normally, exercise stimulates an increase in sensitivity of the insulin receptors for insulin. However, this is significantly reduced in patients that do not exercise as much. Combined with the constant hyperglycaemia, the body downregulates its response to glucose and a resulting diabetes develops.

Type II diabetes may require treatment as for type I diabetes but is – at least in the initial stages – very amenable to changes in diet and lifestyle. **Weight loss and increased exercise may completely cure many of these patients if done in a timely fashion and in conjunction with one another!**

Clinical signs (symptoms)

Pets with diabetes often develop an enormous thirst and may treble their usual daily intake of water. They also need to urinate on a regular basis and will urinate more frequently, for longer, or a combination of both of these. The urine may appear darker than usual or may change its smell. Vomiting and diarrhoea are not uncommon signs to encounter, and are associated with the change in circulating sugar levels. Pets may become very lethargic (tired). Frequently, they are extremely hungry and may beg for or steal food – despite the hyperglycaemia, these pets are starving. In unmanaged cases where pets are developing toxicity from the glucose (known as ketoacidosis), their breath may smell like pear drops. **It is important to note that not everyone is able to smell the acids produced (the pear drop smell) so owners may be unaware that their pet is in a crisis state.**

Diagnosis

Diagnosis of diabetes mellitus is based on the demonstration of glucosuria (glucose in the urine) at the same time as hyperglycaemia (elevated blood sugar levels). However, if the blood sugar level goes up for a short period of time, as can happen during periods of stress or as a sequel to some other diseases, there will be a concurrent glucosuria. It is therefore common to confirm the diagnosis with a blood test for the fructosamine level, which demonstrates a continual period of hyperglycaemia has been experienced by the pet for at least the previous two weeks.

Newly diagnosed or suspected diabetic patients will usually need to have a blood glucose curve performed, which is a series of glucose measurements taken every hour throughout the day. This gives a graph of glucose use within the body and allows a suitable insulin dose to be calculated. Blood glucose curves will need to be repeated periodically during the life of the pet, usually every 6-12 months, but can be more frequent or more spread out depending on the clinical stability of the patient.

To try to determine the type of diabetes, an ultrasound scan of the kidneys and pancreas may be recommended. This may also alter the recommended treatment depending on the findings.

Commonly encountered sequels to diabetes mellitus

As previously stated, the effect of diabetes within the body are wide-ranging. Here is a list of commonly encountered conditions that may be a result of the diabetes or occur concurrently with it:-

- ❖ Cataracts (irreversible) and blindness
- ❖ Renal damage causing chronic or acute insufficiency

- ❖ Fatty liver disease (the body starts to break down fats instead of carbohydrates because it is starving)
- ❖ Changes in hearing or smell of the patient
- ❖ Hypertension (high blood pressure)
- ❖ Recurrent cystitis and urinary tract infections, which may track up to the kidneys
- ❖ Secondary infections are common because of the increased glucose in the blood, which provides an ideal multiplication medium for bacteria
- ❖ Cardiac disease
- ❖ Foot or leg injuries that cannot be treated and may require amputation
- ❖ Diabetic ketoacidosis – acids from protein break-down (instead of carbohydrate break-down) build up in the blood and cause a crisis for the patient. **This is a life-threatening condition and treatment must be sought immediately.**

Treatment

The treatment of diabetes mellitus will largely depend on both the cause and the response to trialled treatment. It must also take compliance into consideration: there is no point in trying to give insulin via injection if the owner is not present or is unable to give it, or if the patient has other ideas about receiving the injections!

For most cats, the initial treatment is likely to be a change of diet onto a veterinary feline diabetes diet. This change alone can effectively manage the disease in many cats, and many of them may revert to a disease-free state. In these cases, it is thought that the diabetes follows a path more akin to that of pregnancy diabetes in people. A reduction in stress factors and concurrent weight loss (if required) can significantly improve the response to treatment.

Dogs may also be changed onto a veterinary diabetic diet and weight loss is advisable in the vast majority of cases (although not all). However, it is far less frequent in dogs than in cats for diet alone to manage the condition effectively.

Many dogs and cats may require injections of insulin to manage the condition. This is most likely to be a life-long requirement (except in cats that revert) and requires dedication from both owner and pet alike. Most commonly, injections are administered twice a day on a twelve-hourly cycle and are given under the skin. There are now veterinary instruments available for home use to ensure that doses are administered as accurately as possible, and these are well worth investing in – please speak to your vet about these.

In some cases where injections are unfeasible, oral hypoglycaemic agents may be given. These are nowhere near as effective as insulin injections but do offer an alternative in different species such as birds, and in cats that refuse to be handled! Oral hypoglycaemics may be administered twice a day but frequency depends on the individual.

In all cases, it is extremely important to regulate food intake. The food consumed each day must be identical and must be given at the same times to allow the correct insulin dose to be calculated for your pet. Any fluctuations can be catastrophic, resulting in a loss or sudden increase in blood sugar levels.

On-going care and expenses

Diabetes mellitus is by no means an easy or cheap condition to treat! Patients with diabetes can be difficult to diagnose and to stabilize, especially if they are first presented in a crisis state, which can take days to weeks of intensive care (in hospital) to resolve. Regular fructosamine readings and blood glucose curves will be required whilst the insulin levels are titrated for the individual, which can take months. Other blood tests will also be required to check the condition of the kidneys and liver, the salt balances, and to check other organ systems. Maintained glucose levels are crucial to all tissues, but elevated glucose over a long period of time can be damaging and further supportive treatments may be required. This is particularly true of dogs with concurrent hyperadrenocorticism or cats with concurrent chronic renal insufficiency. If your pet requires any anaesthesia or surgery during their condition, it is worth noting that diabetes mellitus can affect anaesthetic safety and can be detrimental to wound healing. As with people, diabetes in animals results in poor blood flow to the peripheral regions, so foot injuries can be extremely challenging to treat.

How will my pet's diabetes affect me?

If your pet is diagnosed with diabetes mellitus, there may be intensive treatment and care routines in place for which you must be available. If you decide to treat your pet's diabetes, you will need to have perseverance – injections are a learning curve for both the owner and the pet, and time and commitment are required by both parties! Perhaps surprisingly, even the most ferocious of patients often learn to tolerate injections well given time.

Injections and oral medications should be given twelve hours apart, or as close to this as possible, so working times can be affected. This is also a consideration with regard to feeding: diabetic patients must be fed the same each day, and if this involves a snack or meal during the working day, you or someone else must be reliably available to provide this food.

Increased expenditure should not be under-estimated! A financial commitment must be made from the start. It is likely that all diabetic patients will suffer from a sudden downturn in health at some stage within the disease progression, and this should be budgeted for in advance where possible. Veterinary diets are also more expensive than some commercially available diets, so this should be factored in when creating budgets.

If you have an aversion to needles, please think seriously about whether giving injections will be a realistic option for you, or whether someone else will need to do this (and will be available to do so) for you. Time will need to be set aside for initial training sessions with your vets on how to administer medications and the danger signs to watch out for, as well as for the regular check-up appointments and tests.

It is not always possible to treat diabetic patients for a number of reasons including owner and patient factors, as well as financial factors. Regardless of whether treatment is provided or not, diabetic patients will have a reduced lifespan compared with healthy animals. Treatment may stabilize patients for months to years, whilst untreated patients may rapidly destabilize. In these cases, euthanasia may be recommended if diet alone cannot provide enough relief.