



Diabetes Mellitus

Diabetes mellitus (or 'sugar diabetes') is a complicated condition caused by either an absolute or relative lack of the hormone insulin.

Insulin is produced by special cells in the pancreas (an organ close to the liver) and this hormone is critical in the control and utilisation of blood glucose (sugar). Insulin is produced and released into the blood in response to increasing levels of blood glucose, and this allows the glucose to be taken up by cells in the body (and used for energy) and helps to maintain normal levels of glucose in the blood.

If insulin is deficient, blood glucose levels will rise, and the body will not be able to use glucose efficiently as a source of energy, depending instead on other sources such as breakdown of fats.

Diabetes is one of the most common endocrine (hormonal) disorders of cats, but fortunately in most cases it can be diagnosed and managed successfully, although management options can be quite complex and treatment has to be adjusted to the individual cat.

What causes diabetes?

Diabetes in cats appears to be very similar to type II or non-insulin dependent diabetes in humans. The disease is characterised by abnormalities within the pancreas that interfere with the ability to produce insulin, and also with so-called 'insulin resistance' - a reduced ability of the tissues in the body to respond to the insulin that is produced. Together these combine to cause diabetes.

Type I diabetes in humans is caused by an auto-immune disease that results in destruction of the cells in the pancreas that produce insulin. Although this has been seen in the cat, in contrast to dogs, this form of disease appears very rarely in cats.

Diabetes may also occur in cats as a secondary disease – i.e. secondary to another disease or to certain forms of drug therapy. Some other endocrine diseases such as hyperadrenocorticism (an excessive production of cortisol from the adrenal glands), or acromegaly (an excessive production of growth hormone from the pituitary) can strongly impair the response of tissues to insulin and result in diabetes. The same can happen occasionally when certain drugs are used such as prolonged high doses of corticosteroids or progesterone-like drugs (progestagens).

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Clinical signs of diabetes

Diabetes is mainly a disease of middle-aged cats and older, and is more common in male cats than females. The disease is also much more common in neutered cats and overweight cats - being overweight and leading a sedentary lifestyle are two of the most common causes of an impaired tissue response to insulin (insulin resistance) which is a critical component of the disease.

A genetic predisposition to diabetes is well recognised in humans, and there is evidence that this may also be true in cats. In some countries at least, the Burmese cat appears to be predisposed to developing diabetes, and the disease appears very common in some lines of Burmese.

The most common clinical signs seen in diabetic cats are:

- Increased urination (polyuria) - the increased blood glucose levels mean that glucose spills over into the urine drawing water with it, thus creating a larger volume of urine
- Increased thirst (polydipsia) - to compensate for the water that is being lost through increased urine production
- Weight loss
- Increased appetite (polyphagia) - this is not invariably present, but in some cats will be marked

The severity of these signs will vary between individuals, and some will be more subtle than others. Some additional signs may also be seen including:

- Enlargement of the liver (hepatomegaly) - which may be evident on examination by your vet
- Poor coat
- Weakness, especially of the back legs caused by diabetes damaging the nerves (diabetic neuropathy) - this may result in 'sunken hocks'
- Diabetes may predispose cats to secondary bacterial cystitis so they may show signs of bladder infections (straining to urinate, passing blood in the urine).

Most diabetic cats remain well in themselves but prolonged severe diabetes may occasionally result in a complication referred to as diabetic ketoacidosis. In this situation, the cat may become extremely depressed with signs such as vomiting, diarrhoea, anorexia, and collapse. Any signs such as these should prompt immediate assessment by your vet.

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Diagnosis

The clinical signs may suggest a diagnosis of diabetes, but other conditions may also produce similar signs so further testing is necessary to confirm a diagnosis. This is usually done in the form of blood and urine tests:

- Analysis of a urine sample will reveal the presence of glucose. Ketones (which are used as an alternative source of energy during diabetes) may also be present in the urine.
- A blood test should show the presence of a high concentration of glucose, and your vet may also look at fructosamine and/or glycosylated haemoglobin concentrations - these tests measure the quantity of glucose that has become bound to different proteins in the blood and give an idea of the average blood glucose concentration during the preceding weeks.

Although the presence of hyperglycaemia (a high blood glucose) and glycosuria (glucose in the urine) are typical findings for diabetes, these changes can also occur in some cats simply as a result of stress. If there is any doubt about the diagnosis, your vet may want to wait a little while and repeat the tests, or do some additional investigations (such as the fructosamine or glycosylated haemoglobin tests mentioned above).

Treatment of diabetes in cats

Diabetes mellitus is usually a treatable condition but it is not a simple disease to manage and does require dedication and commitment from owners. Nevertheless, it can be an extremely rewarding problem to manage when things go well.

Management of predisposing factors

Initially it is important to identify any predisposing or complicating factors - for example if drugs are being given that may be causing the diabetes, these should be gradually withdrawn.

Dietary management

There are two major considerations with dietary management of diabetic cats. Firstly, if the cat is overweight or obese it is very important to normalise their body weight. This itself may result in resolution of the diabetes (because obesity interferes with the action of insulin). Weight loss can be achieved through a combination of reduced calorie intake and increased exercise, although the latter can be challenging in cats. If your cat is significantly overweight then your vet may suggest a

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special weight reduction diet to help.

As a routine, cats with diabetes appear to benefit greatly from a diet that is low in carbohydrates. Several studies have shown that cats with diabetes are easier to manage, have lower insulin requirements and in some cases the diabetes actually resolves, simply by changing them to a diet that is very low in carbohydrates. Some diets available from your vet are specifically made to meet the requirements of a diabetic cat, but if these are not available feeding a low carbohydrate kitten diet may be a suitable alternative- talk to your vet about these options.

Oral drugs to control diabetes

In humans with diabetes a number of oral drugs (tablets) are available that can help control the condition. Many of these are either toxic to cats (so should not be used), or simply do not work in cats. Some tablets (so-called oral hypoglycaemics- tablets that lower blood glucose) can work in a small proportion of diabetic cats, but their long-term use is a little controversial. Nevertheless, this may be an option occasionally for cats that are very difficult to inject with insulin.

Using insulin injections

Most diabetic cats will need to have their diabetes managed with daily or twice daily injections of insulin, just as is needed for many humans with diabetes. Although the prospect of having to inject your cat once or twice a day is very daunting for most owners, it can actually be very easy to do with practise, and because insulin syringes and needles are so small, the cat usually does not feel a thing. The injection is given under the skin, usually in the scruff of the neck.

Your vet (and perhaps vet nurse) will help by talking you through the whole procedure and letting you practise before ever having to give insulin to your own cat. Sometimes practising by injecting water into something like an orange can help to get the feel of how to handle the syringe and needle and gain confidence. It is usually easiest to try to inject your cat when they are distracted with other things (for example when they are eating a tasty treat), and to begin with it may be better to have a second person who can help hold your cat, although with practise this will not be needed.

Several different types of insulin are available- some are specifically licensed for use in dogs and cats, others may be licensed for use in humans but still suitable for dog and cat use. In general, insulins are divided into:

- Short-acting preparations (eg, soluble insulin)
- Intermediate-acting preparations (eg, lente insulin)
- Long-acting preparations (eg, protamine zine insulin [PZI], insulin glargine, insulin detemir).

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Individual cats may respond differently to different insulins, but most cats will require twice daily injection of an intermediate- or long-acting type of insulin, although some cats can be managed with once daily injections.

Storing and handling insulin

It is important to store insulin properly so that it maintains its efficacy. Insulin should be kept in a fridge at all times, and never frozen. Before drawing up insulin into a syringe, the contents of the bottle should be gently mixed so that an even suspension is obtained, but you should not shake the bottle as this may damage the insulin.

- Always carefully follow the instructions from your vet when using the insulin
- Carefully draw up the correct amount of insulin in the syringe. Occasionally insulin pens are used which help to make administering small amounts of insulin easier
- If you are not sure whether an injection was given successfully, **never** give a second injection. It is better to miss a dose rather than risk giving too much insulin.

Stabilising a diabetic cat

Many vets will hospitalise diabetic cats undergoing initial stabilisation. Insulin is given and regular blood tests are used to monitor the effect on blood glucose concentration. This allows adjustments to be made to the insulin dose (and if necessary a change in the type of insulin or frequency of injection) to get good control of the diabetes.

In some cases, this may also be done on an out-patient basis with intermittent trips to your vet to check blood glucose. In these cases it may take a little longer to stabilise the cat as changes in the insulin dose will be made slowly to avoid causing problems.

Long-term management of the diabetic cat

Day to day routines, feeding (type of food, frequency), activity, and body weight should be kept as constant as possible as this will help minimise fluctuations in insulin needs. Once a diabetic cat is stable, the dose of insulin may still need to be adjusted on an occasional basis. Only do this in consultation with your vet though.

Several things will help you and your vet to monitor your diabetic cat. Your vet will, from time to time, want to:

- Check blood samples to look at blood glucose and fructosamine and/or glycosylated haemoglobin concentrations

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(see above)

- Check the weight of your cat
- Check urine samples (for glucose and ketones, see above)
- Check the general health of your cat

To help you and your vet manage the diabetes, it is extremely helpful if you are able to keep a daily diary and record key things on a day-to-day basis. Looking at the trends and changes in these parameters over time can be extremely helpful in managing your cat.

Keep a daily note of:

- The time of injection and the amount of insulin injected
- The cat's appetite and the amount of food eaten
- The overall demeanour of your cat, noting particularly if they become lethargic or more sleepy than usual
- The presence of any vomiting or diarrhoea
- If at all possible, measure the amount of water your cat drinks each day- use a measuring jug to fill their bowl and at the end of the day tip the water back into the jug to see how much they have drunk. Measuring the water intake is *one of the most useful ways* to monitor how well the diabetes is controlled. Even if you have more than one cat in your house, measuring how much they all drink may still be a useful guide.

Some other things are very useful to record in the diary:

- Weight- If possible, also keep a weekly note of your cats weight and record this in the diary as well. Take the diary with you whenever you go to the vet so that you and your vet can review what has been happening.
- Urine glucose- Your vet may suggest you collect a urine sample from your cat from time to time so that you (or your vet) can check for glucose in the urine with a very simple paper-strip test.

Changing the dose of your cat's insulin

Only change the dose of your cat's insulin after first talking with your vet. In particular, you should never give more insulin unless your vet has told you to.

This is important, as giving too much insulin can cause a condition called hypoglycaemia, where the blood glucose concentration is too low.

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The signs of hypoglycaemia are generalised weakness, disorientation, the cat may appear as though it is intoxicated, it may collapse and this can progress to seizures and/or a coma. This is a **life threatening** situation and requires urgent action. If your cat ever shows any of these signs, contact your vet immediately. In the meantime it is helpful to administer some glucose syrup or powder by mouth to your cat. As a precaution, it is always best to have a small bottle of glucose syrup (available from your vet or a pharmacist) in the house when you have a diabetic cat.

Prognosis

The long-term outlook for cats with diabetes mellitus varies according to how old they are, how easy it is to stabilise their diabetes, whether they have any other diseases and how severe these are.

Many diabetic cats have an excellent quality of life, and many can live very happily with their diabetes if they are well managed. These cats can be extremely rewarding to manage, but not every cat responds well.

Your vet will want to undertake regular examinations to evaluate the response with your cat, and if your cat proves difficult to stabilise, becomes unstable, or appears to need very large doses of insulin, further tests may be needed to look for other underlying problems.

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