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Diabetes Mellitus in Cats

Diabetes mellitus (DM) is a disorder of carbohydrate, fat and protein metabolism. It is caused by the body's inability to either produce or properly utilise the hormone insulin. This results in excessive amounts of glucose in the blood stream (hyperglycaemia) and the urine (glycosuria).

Clinical signs can vary a lot depending on the individual, the severity of the condition and how long the animal has had the condition.

Most common signs of diabetes in cats are:

- Drinking excessively (Polydipsia)
- Increased appetite (Polyphagia)
- More frequent urination or increase in the volume of urine produced (Polyurea)
- Weight loss – Usually muscle first (“my cat feels boney”) then fat.



These are the most notable signs seen at home. Due to the high blood glucose level the kidneys can no longer prevent its loss into the urine. This loss of glucose in the urine takes water with it. This means there is more urine to get rid of (Polyurea). The water loss from the kidneys would rapidly cause the cat to become dehydrated if it did not drink more to compensate for this extra loss. So this leads an increase in the cats drinking (Polydipsia). The body thinks there is not enough energy so it causes the appetite to increase (Polyphagia). Despite this increase in appetite the glucose can't get into the cells so the body starts to break down its own resources muscle and then fat leading to the weight loss. Usually despite these quite dramatic clinical signs the cat may well be bright and happy in it self. Also if your cat drinks and toilets outside this can go unnoticed.

Other clinical signs

- Coat – This can become oily/greasy looking with excessive dandruff
- Liver enlargement – This may be mentioned by us at examination
- Jaundice – This is a yellow colouration to skin or white part of the eyes.
- Blood or Straining to Urinate – As the urine becomes more dilute and sugary, bacteria can start to multiply in the bladder and cause cystitis
- Cataracts – The black part of the eye becomes white and cloudy (Uncommon)
- Neuropathy – Causes the animal drop and walk with a lower stance
- High blood pressure (Hypertension)

There is a very serious potential complication called ketoacidosis that can occur suddenly in any uncontrolled diabetic patient. This can cause severe depression, vomiting, diarrhoea, lack of appetite, dehydration, collapse, coma and then death. This condition can rapidly worsen and is an emergency. Any cat that is suspected of having ketoacidosis needs to be seen immediately.

What is Insulin?

Insulin is a hormone produced by special Islet cells inside the pancreas. The pancreas is an organ situated near the outflow from the stomach and the start of the duodenum. It also has a role in producing some very important digestive enzymes. Insulin is released into the blood stream where it travels to all parts of the body and affects all cells. It allows cells to take up glucose (a type of sugar) where it is utilised as a source of energy. Insulin does also affect the uptake of amino acids, fatty acids and potassium into the cells. It also helps regulate glycogen storage and fat metabolism by the liver.

What is happening to my cat when he or she has Diabetes Mellitus?

In a diabetic cat there is either too little insulin produced or the insulin does not work correctly on the cell wall. This inhibits the cells from absorbing the glucose from the blood stream across their cell walls. This effectively starves the cells. Even though there is plenty of glucose in the blood stream the cells think there is not enough. So the body starts to break down first muscle then fat reserves to make more glucose. This causes the blood glucose to increase further and the cat then starts to loose weight. The production of glucose from fat is very inefficient and can lead to a build up of some waste products ketone body's that can make the cat feel very unwell.

Why has my cat got diabetes?

The vast majority of diabetic cats are middle aged (8-13yrs) but the condition can occur in nearly any age of animal. We know that male neutered cats, Burmese cats and house/less active cats are more likely to get the condition.

The biggest known contributing factor by far though is **Obesity**. Being over-weight makes cells resistant to the effects of insulin. So the pancreas has to produce more insulin to have the same effect. If this increase in amount of insulin is unable to compensate for the resistance to its effects, then the animal will develop clinical signs of the condition. Also if this state of overproduction goes on for too long this can result in the pancreas becoming exhausted and so it can no longer produce insulin. There are other possible causes including chronic pancreatitis, genetic susceptibility, amyloid, drugs (e.g. steroids) and other diseases (e.g. acromegaly). It is more than likely that in many cats the condition is caused by more than one thing happening at the same time.

How do we diagnose Diabetes Mellitus?

A suspicion of the condition is made on the presence of compatible clinical signs. Unfortunately none of these clinical signs are unique to diabetes and can also occur with many other common diseases of middle aged and older cats. To diagnose diabetes we must rule out other conditions that can have similar presenting signs (e.g. kidney failure, over active thyroid etc) and confirm the presence of high levels of glucose in the blood and in the urine. This is done by taking a blood sample and collecting a urine sample. A complication with diagnosis can be that stress in cats can cause a sudden increase in blood glucose in a non diabetic animal and can be severe enough in a small number of animals to cause glucose to appear in the urine. So in cats mild clinical signs we may need to do additional tests. This can be a urine sample taken at home in a low stress environment or an additional blood sample to measure Fructosamine. Fructosamine is not affected by the sporadic changes caused to the blood glucose level by stress. It increases in response to persistent a hyperglycaemia over the preceding 2-3weeks.

My cat has been diagnosed with Diabetes Mellitus what are my options for treating it?

The key is early diagnosis and rapid stabilisation. If we can get the animal stable before the diabetes has gone on too long and correct any underlying contributing conditions (e.g. losing weight in an obese animal). The diabetes may be reversible in some animals so they will no longer be dependant on insulin injections.

- **Correction of underlying or complicating factors.**

Bacterial cystitis – It is a common problem found in diabetic cats and can lead to the cells being resistant to insulin (all diagnosed diabetics need to have a urine culture done). If found it is usually easy to treat.

Neutering – Entire female animals will need to be neutered as the hormones released during their cycle can cause instability in their diabetic control.

Dental Disease – In a similar way to cystitis the bacterial load in the mouth associated with dental problems can prevent the insulin from working so a diabetic animal will need to have any dental problems corrected.

Obesity – This leads to insulin resistance and so if an animal is overweight a weight loss program will need to be initiated.

- **Dietary management**

In most cases normal cat food is completely unsuitable for a diabetic animal (it is digested and releases its energy far too rapidly). Also whether the cat is under weight, normal or obese will need to be taken into account when choosing the most suitable diet. A high protein low carbohydrate diet is usually most suitable (such as Hill's m/d). Though in very obese animals a high fibre low calorie diet (such as Hill's r/d) may be more suitable. New diets need to be introduced slowly (over the course of 1-2 wks) by mixing with the cat's normal food. Though ideally the meals are given twice daily at or just after each insulin injection. Some cats will not adjust to this kind of change in routine and will need to be fed at their normal times or ad lib.

- **Insulin Therapy**

In almost all cases the cat will need to have twice daily (12hrs apart) injections of insulin. Caninsulin (which has an intermediate duration and is of a type called Lente) is the most commonly used insulin to start with. Though insulin behaves differently in different animals so it is sometimes necessary to change onto a different type. With training injecting your cat is usually easy to do. The insulin is kept in the fridge. When needed it is removed from the fridge and mixed by gently inverting the bottle 5-6 times (do not shake it). The required dose (measured in international units) is then drawn up into special insulin syringes (these are specific to a type of insulin). The needle is very small and most cats barely notice the injection which is done under the skin in the neck area. The syringe is then disposed of in the provided sharp safe.



There is a new method using an insulin pen and cartridges. This provides more accurate dosing and does not need to be kept in the fridge. For more information on this product please visit:



<http://www.caninsulin.co.uk/>

Even if the bottle of insulin has not been completely used it should be disposed of 28 days after opening and a new bottle used.

How do we stabilize and monitor the diabetes?

If the cat is unwell (sleepy, reduced appetite, ketones in the urine etc) initial stabilisation will need to be done in hospital at the surgery. If the animal is well in themselves and just has excessive drinking or weight loss this can usually be done at home. The cat is started on an initial starting dose of the insulin. This will be usually less than is required to stabilise the patient but as the effects of insulin vary a lot between different animals. It is important to start low and gradually increase the dose. Initial monitoring usually starts one week after the cat has been consistently having the insulin and new food. There are different methods of monitoring these have different advantages and disadvantages and often a combination are needed.

- **Clinical Signs**

If the cat has obvious clinical signs of diabetes then as we gain control these should start to disappear. E.g. a cat that has weight loss, is drinking a lot and urinating a lot should stop losing weight and start to drink and urinate normal volumes of fluid. This is cheap and reasonably accurate in the initial stabilisation process but complicating problems like the animal urinating in the garden or having cystitis can cloud the picture.

- **Glucose Curve**

This involves taking 1-2 hourly blood glucose level using a hand held meter called a glucometer (www.alphatrakmeter.co.uk) then plotting the results on a graph over a 12-24hr period. This can be done in hospital at the surgery or at home with correct training. This allows weekly changes to insulin if required allowing rapid stabilisation. It is the most accurate and allows us to spot complications early. The problem is that some animals become stressed in hospital which can cause abnormal glucose readings. Due to this it is better to be done by the owner at home but this is not always practically possible for various reasons



- **Fructosamine**

Fructosamine is a compound measurable in the blood that gives an indication of how stable the blood glucose has been over the previous 1-3 weeks. It is usually unaffected by stress and is a relatively easy method of monitoring. Stabilisation is slow with this as adjustments can be only made every 3 wks which is not ideal. Also there are other things that can effect its level and in some individuals seems to be of no use giving erroneous readings.

- **Urine Test**

Urine glucose and ketone levels can be easily measured at home. Urine glucose is a very poor method of monitoring for stabilisation as even a very stable diabetic will still have glucose in the urine. It is mainly used to monitor unstable diabetics to pick up early the presence of ketones in the urine indicating ketoacidosis which may prevent a hospital stay.

- **Spot Glucose**

This is using the glucometer mentioned earlier to measure a one off glucose reading rather than doing a curve. This is almost useless as there are many things that can affect the blood glucose at one exact moment. It is some times used to check the blood glucose at the expected time of peak effect of the insulin check a patient does not become hypoglycaemic.

In most cases a combination of clinical signs and either glucose curves or fructosamine readings will be needed to assess the cat's response to the insulin. Depending on the results a dosage change may be indicated. If the cat is stable then monitoring is usually repeated every 3 months. If the animal is not stable then the insulin dose will be adjusted then the cat will be re checked 1-3wks later.

What problems can occur and what should I do?

Diabetes and the animals response to the insulin varies with the individual and changes in the home environment. We cannot exactly replicate the function of the pancreas with two injections a day of insulin at best we can keep the animal comfortable and clinically stable. Any change in thirst, appetite, urination, demeanour or weight gives an indication there may be a problem. It is much better to make an appointment. So it can be addressed early. So the animal can be

restabilised with a minimum of visits, stress and cost. There are two complications that are a medical emergency and require immediate action and hospitalisation.

- **Hypoglycaemia**

This is where the blood glucose drops too low due to too much insulin usually occurs 4-6 hours after the insulin has been given. This causes weakness and wobbliness (look drunk as walking). The animal will be come mentally dull and lethargic. This then progresses to collapse, seizures and then coma. If the animal is still conscious feed it immediately. If the animal won't eat or is unconscious then rub a sugar solution or honey onto the animals gums. Phone the surgery to let us know you are coming and we will instruct you from there

- **Ketoacidosis**

If the diabetes is unstable glucose is not getting into the cells so the body thinks there is not enough and starts to produce more from fat stores. This creates waste products that make the animal feel very unwell called ketone bodies. Signs of this are lack of appetite, vomiting, lethargy, depression, dehydration and smelly breath. This requires hospitalisation to correct.

All diabetics have to be managed as individual cases there is no one thing that fits all. Some are very easy to stabilise some are not. We provide free nurse clinics to help and support you while you get used to injections and blood glucose monitoring.

<http://www.fabcats.org/owners/diabetes/>