Complications of Diabetes in Cats

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At a glance:

- Ketoacidosis
- Diabetic nephropathy
- Neuropathy
- Hypoglycemia
- Cataracts
- Urinary tract infections
- Weight loss
- Hepatic lipidosis

What is diabetes?

Diabetes is an endocrine disorder in which the pancreas doesn't make enough (or any) insulin due to the destruction of the pancreatic beta cells (type 1 diabetes) or the cells within the body fail to respond to insulin, known as *insulin resistance* (type 2 diabetes). Glucose levels build up in the blood, but it cannot enter the cells, where it provides energy.

Most of the complications relate to uncontrolled diabetes. This highlights the importance of diligent control and regularly monitoring your cat.

Ketoacidosis

When hyperglycemia (high blood glucose) occurs, the body breaks down fat as an alternate fuel source. Fat is the backup fuel option, however, when the liver metabolises fat, waste products known as ketones are released which causes the blood to become too acidic (known as metabolic acidosis). The body tries to get rid of ketones by increasing urination, which leads to dehydration. Blood glucose levels remain high.

Causes

- Missed meal
- Missed insulin administration
- Insufficient insulin
- Infections
- Concurrent illness (pancreatitis, hepatic lipidosis)
- Obesity
- Recent surgery

Symptoms

- Increased thirst
- Increased urination
- Dehydration
- Increased or decreased appetite
- Diarrhea
- Lethargy
- Confusion

Treatment

- Intravenous fluids to treat dehydration
- Administration of insulin
- Treating the underlying cause if there is one.

Diabetic nephropathy (diabetic kidney disease)

A type of chronic and progressive kidney disease caused by high blood glucose levels which damage the tiny filtering structures (glomeruli) in the kidneys.

Causes

It is the role of the kidneys to clean the blood, removing waste products via the urine while re-capturing important substances. Long-standing high glucose in the blood of diabetic cats as well as high blood pressure damage these filters. As damage occurs to the filtering units, important proteins, in particular, albumin are lost via the urine.

- High blood pressure increases the pressure within the capillaries, which increases the filtration rate within the glomerulus.
- Vasoconstriction of the efferent arteriole occurs in response to renin (a hormone secreted by the kidney when there is a drop in fluid volume within the body) in order to maintain blood pressure and volume status. This too causes an increase in the filtration rate. The exact physiology still is not known, but it is believed that hyperglycemia directly affects the intra-renal renin-angiotensin-aldosterone system which leads to efferent vasoconstriction. As the pressure within the kidney increases, the *mesangium* (a structure within the glomerulus which supports the capillaries) expands, inflammation occurs, which causes damage to the filtration system which becomes leaky.

Symptoms

Early diabetic nephropathy may produce no symptoms at all, it is only when a significant amount of damage has occurred that symptoms may present, which may include:

- Increased thirst
- Increased urination
- Dehydration
- Nausea or vomiting
- Weight loss
- Loss of appetite

- Lethargy
- High blood pressure

Treatment

Ensuring that blood sugar levels remain within normal range with regular meals, insulin administration and careful monitoring of blood glucose levels. Phosphorous levels can build up in the blood of cats with kidney disease as the kidneys become less effective in filtering the blood.

- As well as diabetic control, treatment is the same as that of kidney disease and may include:
- Managing high blood pressure with medication if necessary.
- A high-quality diet which is reduced in protein and phosphorous.
- Phosphorus binders can help reduce absorption of phosphorus from the diet.
- Ensuring adequate water intake and treating dehydration with intravenous fluids where necessary.
- Erythropoietin is a hormone produced by the kidneys which stimulate red blood cell production in the bone marrows. Failing kidneys often have a low red blood cell count due to lower levels of this hormone. The only form available is the human form, this may be administered if your cat has become anemic.

Neuropathy

A common complication caused by persistent hyperglycemia, neuropathy is a type of nerve damage which occurs as a result of prolonged levels of high blood glucose. In cats, the nerves in the hindquarters are most often affected (peripheral neuropathy), however, it can also affect the stomach (gastroparesis).

Causes

There are a number of factors which contribute to the development of neuropathy, which aren't fully understood yet. It is believed, in part due to a cascade of events including narrowing of the blood vessels, proteins and lipids becoming glycated (advanced glycation end products) and excessive release of cytokines (a group of proteins produced by the immune system which act as chemical messengers).

Symptoms

Hind legs: The most common symptom of diabetic neuropathy is a progressive weakness in the hind legs. Affected cats will have difficulty jumping and develop a *plantigrade stance*, meaning instead of walking on their toes, as they normally do, they walk on their hocks.

Treatment

If caught early, diabetic neuropathy can be reversed. Treatment is aimed at correcting hyperglycemia with proper diabetic treatment, following dietary guidelines, Methylcobalamin (vitamin B-12) supplements and close monitoring of your cat's glucose levels.

Hypoglycemia

This is a serious and life-threatening condition in which the level of glucose in the blood falls dangerously low. When this occurs, the cells are starved of glucose, necessary for energy. The brain is most at risk as the brain relies on glucose alone for energy, while other cells can use alternate forms (protein or fat) when glucose levels drop.

Causes

Poorly regulated or newly diagnosed diabetes are the causes of hypoglycemia, these may include:

- Improper glucose administration (too much insulin)
- Missed meals
- Vomiting
- Certain medications

Other causes of hypoglycemia:

- Addison's disease
- Insulin-secreting pancreatic tumour
- Glycogen storage disease
- Liver disease
- Sepsis (bacterial infection of the blood)

Symptoms

Most of the symptoms of hypoglycemia relate to neurological dysfunction, symptoms vary depending on the severity of the condition but may include:

- Increased appetite
- Wobbly, drunken gait
- Nervousness
- Heart palpitations
- Disorientation
- Weakness
- Shaking
- Poor coordination
- Seizures
- Coma

Treatment

- Hypoglycemia is a medical emergency and any hypoglycemic cat should be seen by a veterinarian.
- If your cat is still conscious and able to swallow, rub some corn syrup, honey or maple syrup onto his gums and then take him directly to his veterinarian.
- If he is unconscious, take him to the veterinarian and administer glucose as outlined above along the way.
- Your veterinarian will check his sugar levels and administer intravenous dextrose if necessary.
- Glucocorticoids such as prednisone stabilise blood sugar levels.
- Regular monitoring of your cat's blood glucose levels will be necessary until they become regulated.

Cataracts

Less common in cats than dogs, cataracts are a clouding of the lens within the eye which results in impaired

vision. There are many possible factors which can lead to cataracts including diabetes. Either part of or the entire lens can be affected and they may develop in one or both eyes.

Causes

The lens receives its nutrients from the aqueous humor, in the cat with diabetes, high blood sugar leads to high glucose levels in the aqueous humor. From there it enters the lens where it is converted to sorbitol (which is a form of modified glucose). Sorbitol can affect cells and proteins in the lens, as well as that, high levels of sorbitol in the lens which can not be used cause the lens to become hypertonic, and water is drawn into the lens causing it to swell.

Symptoms

- Blue/grey cloudy spots in the eyes
- Poor vision, such as bumping into objects, reluctance to jump

Treatment

Phacoemulsification -Surgery to remove the lens which is liquefied using ultrasonic waves. An artificial lens will be placed in the empty lens capsule.

Extracapsular lens extraction – This procedure may be necessary if the surgery doesn't have the necessary equipment to perform a phacoemulsification, or the lens is too solid.

Urinary tract infections

Causes

Higher levels of glucose and protein in the urine as well as a compromised immune system in the diabetic cat can make a favourable environment for bacterial growth within the urinary tract.

Symptoms

- Frequent trips to the litter tray
- Urinating outside the litter tray
- Crying when going to the toilet
- Blood in the urine

Treatment

- Oral antibiotics.
- Ensuring your cat's glucose levels remain stable.

Weight loss

Unregulated diabetic cats are at risk of weight loss due to lack of glucose.

Causes

When glucose is not able to move into the cells from the blood, the body switches to an alternate fuel supply to

provide the cells with energy. This comes from your cat's fat reserves.

Symptoms

Obviously, weight loss is the main symptom. It is often quite hard to determine if your cat has lost weight by appearance alone. Weigh a diabetic cat regularly to ensure his weight remains stable.

Treatment

Ensure your cat's glucose levels remain stable with daily monitoring.

Hepatic lipidosis

Following on from weight loss, if the cat's body starts to use fat stores for fuel, hepatic lipidosis can develop. This is a life-threatening condition which needs immediate and aggressive treatment. Up to 70 % of cats who receive immediate treatment can recover from hepatic lipidosis.

Causes

If glucose is unable to enter the cells, the body sends fat to the liver as an alternate source of fuel. However, the liver is not very efficient at metabolising fat and as it begins to accumulate, the liver cells become overwhelmed and unable to function properly.

Symptoms

- Loss of appetite
- Weight loss
- Muscle wasting
- Vomiting
- Drooling (due to nausea)
- Lethargy
- Jaundice (yellow gums)
- Poor coat condition

Treatment

Intensive nutritional support with a high-calorie food fed several times a day. If your cat is not eating, he will need to have a feeding tube inserted.

Supportive care may include medications to control nausea and vomiting and intravenous fluids to treat dehydration.

Once again, proper insulin administration and regular monitoring of your cat's blood glucose levels and the urine for ketones and his weight are essential.

If you do notice your cat losing weight, or if he loses his appetite, see your veterinarian immediately.