Insulinoma in Ferrets
(Tumor Involving Cells of the Pancreas that Secrete the Hormone Insulin)

Basics

OVERVIEW
- Insulinomas are tumors of the pancreas that secrete excessive amounts of insulin, independent of glucose (sugar) levels in the blood, leading to low levels of glucose in the blood (known as hypoglycemia).
- Insulinoma is one of the most common diseases seen in pet ferrets.
- The beta-cells of the pancreas produce insulin, the hormone that regulates blood glucose (sugar) levels; under normal conditions, insulin responds to changes in blood glucose levels and keeps the blood glucose in a relatively narrow range—if the blood glucose levels increase over a certain level (generally around 110 mg/dL), insulin levels increase to push the blood glucose level down; if blood glucose levels fall below a certain level (generally about 60 mg/dL), insulin levels drop to allow the blood glucose to go up.
- Insulinomas are progressive, even with surgical treatment, since complete excision of all nodules is not possible.

SIGNALMENT
- Usually seen in ferrets over 2 years old, average age is 4 years old
- No sex predilection reported

SIGNS
- Symptoms are usually episodic.
- Symptoms may or may not be related to fasting, excitement, exercise, and eating.
- Ferrets usually demonstrate more than one symptom, and symptoms worsen with time.
- Abnormal mental status such as dullness, irritability, “stargazing,” or staring off into space is a common symptom.
- Symptoms of nausea, characterized by drooling and pawing at the mouth, are common.
- Weakness; usually the hind limbs are more severely affected
- Lethargy, incoordination, and tremors are common.
- With severe disease, ferrets may have seizures or collapse.
- Many of the hypoglycemic episodes may go unnoticed, giving the impression of a sudden onset.
- Emaciation and muscle wasting seen in ferrets with chronic disease
- Symptoms of concurrent ferret adrenal disease (especially alopecia) are commonly seen, as many ferrets have both types of tumors.
CAUSES
• An insulin-producing cancer (known as a carcinoma or adenoma) of the pancreas

RISK FACTORS
• Fasting, excitement, exercise, and eating may increase the risk of low blood sugar.
• Excessive carbohydrate intake may predispose to development of clinical disease.

TREATMENT
APPROPRIATE HEALTH CARE
• Hospitalize for severe hypoglycemic episodes or if surgery is elected.
• Mildly affected ferrets can be treated on an outpatient basis.
• Mild symptoms may be alleviated by administering a small amount of honey or syrups orally (taking care to avoid being bitten), followed by a small, high-protein meal. It is very important to avoid sugary or carbohydrate-based treats; many commercial ferret treats and supplements contain simple sugars.
• If collapse or seizures occur, seek immediate medical attention.
• Make sure that high-quality, high-protein ferret foods are available at all times. Ferrets with advanced or long-standing disease will require food available 24 hours a day.

ACTIVITY
• Restricted during symptomatic episodes

DIET
• The first and most important aspect of management (with or without surgery)
• Feed four to six small meals a day.
• The diet should consist of high-quality ferret foods that are high in animal proteins and low in simple sugars; avoid semimoist food.
• Do not feed sugary treats, as these will cause an increase in blood glucose concentration and a rebound release of insulin.

SURGICAL CONSIDERATIONS
• Surgical removal of all visible tumors confirms diagnosis, may improve survival time, potentially can provide temporary remission, and may improve response to medical treatment.
• Surgery is not possible in all patients. Older ferrets often have other (concurrent) diseases that may complicate surgery. Medical therapy is often a better option in older ferrets or those with concurrent disease. Many ferrets will have similar survival times and symptom-free intervals with medical therapy alone.
• It is not possible to remove all of the tumor, since multiple, small to microscopic nodules are present in the pancreas, and the entire pancreas cannot be removed. Therefore, symptoms will eventually return.

MEDICATIONS
• Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered all-inclusive.

Long-Term Therapy
• Steroids (such as prednisone)—initial medical treatment if diet alone is ineffective; begin with low dosage and gradually increase as signs of low blood sugar (hypoglycemia) recur
• Diazoxide (Proglycem®)—added after diet and steroids have proven ineffective

FOLLOW-UP
PATIENT MONITORING
• At home: monitor for return or progression of symptoms of low blood sugar (hypoglycemia)
• Adjust medication on the basis of clinical signs and blood sugar levels.

POSSIBLE COMPLICATIONS
• Recurrent or progressive episodes of low blood sugar (hypoglycemia)
EXPECTED COURSE AND PROGNOSIS

- With surgical treatment, relatively few ferrets will remain asymptomatic long-term. Most ferrets will require medical treatment or second surgery within 6 months. In one study the average symptom-free interval was 240 days, with an average survival time of 483 days.
- With medical treatment alone, symptoms will be controlled for periods of 6 months to 2 years, depending on the number and type of tumors.

KEY POINTS

- Insulinomas are one of the most common diseases seen in pet ferrets.
- Be aware of signs of low blood sugar (hypoglycemia) and seek immediate veterinary medical attention if they occur.
- Diet is the first and most important aspect of management, with or without surgery.
- In the majority of cases, surgical and/or medical management can provide relatively long, symptom-free periods. However, with both surgery and medical treatment alone, the disease is progressive and symptoms eventually return.