

# Insulinoma in Ferrets

## Introduction

Insulinoma or pancreatic beta cell tumor is an abnormal growth of the beta cells of the pancreas that secrete excess amounts of insulin. Unfortunately, insulinoma is an extremely common disease in middle-aged to older ferrets. As insulin levels rise, blood glucose (or blood sugar) levels fall. Insulin is critical to the body for the regulation of blood glucose levels. After a ferret eats, the carbohydrates in the meal are broken down into glucose, which is an energy source for the body. When glucose enters the bloodstream, the pancreas responds by producing insulin, which then allows the glucose to enter the body's cells to provide them with energy. When an insulinoma is present, insulin is not properly regulated and more than is necessary is released, causing blood glucose levels to fall below normal, resulting in dangerously low blood glucose (hypoglycemia). Blood glucose is needed for the brain to function and for muscles to work normally, and low blood glucose levels can be life-threatening.



- Vomiting
- “Stargazing”
- Increased “speed bumping” (resting lying completely flat)

### Non-specific Signs:

- Weight loss
- Reduced activity (lethargy)
- Rear leg weakness

## Diagnostics

The history provided by you, the owner, along with certain physical examination findings can be suggestive of an insulinoma. Improvement of clinical signs after consumption of food is an extremely important factor in the patient's history when diagnosing insulinoma, as there can be other causes for low blood glucose. Your veterinarian may recommend serial blood glucose testing to confirm a single low blood glucose test. It is important to follow all feeding and fasting instructions when blood tests are scheduled for insulinoma testing, as this may affect results and interpretation.

High blood insulin levels, from the same time a low glucose is recorded, can be used to confirm the diagnosis. In some cases, pancreatic nodules may be identified using ultrasound. A definitive diagnosis of an insulinoma can be obtained with a surgical biopsy and microscopic tissue review.

Your veterinarian may recommend complete bloodwork and radiographs (x-rays) to evaluate your ferret's overall health. It is not uncommon that the results of these diagnostics may be suggestive of other diseases that may affect treatment recommendations. Regular examinations and monitoring of blood glucose levels may also be recommended to monitor for response to treatment.

### Key diagnostics

- Physical examination
- Blood glucose level
- Insulin levels
- Blood work (complete blood count and biochemistry)
- Radiographs (X-rays)
- Abdominal ultrasound

## Treatment

Insulinomas can be treated in one of two ways: surgical or medical management. The best treatment for your ferret will depend on many factors, including age and other health problems.

Surgery involves removing identified pancreatic nodules (nodulectomy) and/or as much of the pancreatic tumor as possible (partial pancreatectomy). Unfortunately, there is no way to remove all tumor cells and even if entire sections of the pancreas are removed, signs of insulinoma will eventually recur within weeks to months, or in rare cases, years. Medical management

## QUICK FACTS



- Ferret insulinomas are common in ferrets between 2 and 8 years old.
- Lethargy, weakness, and pawing at the mouth are common signs of insulinomas.
- **Severe weakness, collapse, or seizures indicate an emergency.** If your pet is not capable of eating, rub syrup (Karo syrup® (Ach Food Companies), simple syrup, other corn syrup, real maple syrup) or honey on the gums. Take care of being bitten if seizures are observed—use a Q-tip or cotton-tipped applicator rather than your fingers!
- Once your pet is more alert, feed a high-quality, high-protein meal such as kibble or Lafeber Company's Emerald Carnivore or Oxbow Pet Health's Carnivore Care and **contact an exotic companion mammal veterinarian immediately. If the ferret is not recovering and you cannot get it to eat seek emergency care immediately.**
- Trouble finding a veterinarian? The AEMV offers a Find-a-Vet tool to help exotic companion mammal owners find veterinarians around the world at [www.aemv.org](http://www.aemv.org)

## Clinical Signs and Symptoms

Ferret insulinomas are typically seen between 2 to 8 years of age (median 5 years). Many ferrets look normal with an insulinoma. Signs of falling blood glucose levels in the ferret may include a dazed or glassy-eyed stare, lethargy, weakness, collapse, and even seizures. Low blood glucose levels (hypoglycemia) can also manifest as rear leg weakness and/or wobbliness in the ferret. Hypoglycemia is also often associated with nausea in ferrets; a nauseous ferret may drool or paw at its mouth vigorously.

### Common Signs:

- Difficulty waking from sleep
- Drooling excessively
- Pawing at the mouth
- Collapse
- Seizures

will become necessary when signs recur. Medical management of insulinomas aims to reduce the amount of insulin that is produced or interferes with the effects of insulin. Common medications used include diazoxide and corticosteroids.

Diazoxide helps to increase blood sugar levels by reducing the amount of insulin secreted by the pancreas. Eventually, diazoxide alone is not enough to control signs of hypoglycemia, and steroid medications can be added. Corticosteroids such as prednisone or prednisolone inhibit the uptake of glucose by cells, resulting in increased blood sugar levels. Usually, the dose of corticosteroids must be gradually increased as the disease progresses. For a time, corticosteroids and diazoxide can control the signs of hypoglycemia, but as the disease progresses, these medications will no longer be sufficient. Long-term use of corticosteroids can also be associated with side effects including changes in the regulation and production of other hormones. There are no consistently reliable additional medications that can be offered at this time.

Nutritional management of ferrets with insulinoma is a crucial element in stabilizing blood glucose levels and reducing dramatic changes in both insulin and glucose levels. Blood glucose levels are best regulated with high protein diets, as sugary or sweet foods stimulate the release of insulin. Ferrets with insulinomas should be fed small, frequent meals of a high protein, moderate fat, low carbohydrate diet.

Regular recheck examinations and monitoring of blood glucose levels may also be recommended to assess response to treatment in either surgical or medically managed cases.

### Risk to Others

Ferret insulinoma is not infectious or transmissible to other organisms.

### Prognosis

There is no known cure for insulinomas. However, surgical and medical management options can provide control of blood glucose levels and a good quality of life for two years or more, depending on the patient.

### Risk Factors

The cause of the development of insulinomas in ferrets is unknown. Ferrets between 2 to 8 years old can be affected. Genetics and nutrition have been suggested as contributing factors to the development of insulinomas. However, there are no recent studies that support these suggestions.

### Home Care

1. Give all prescribed drugs as directed. Corticosteroids frequently increase water intake and urination, so fresh water and litter pans must always be available.
2. Make sure high-quality, high-protein ferret food is always available, as medications may also increase appetite. Ferrets need to eat at least every 4 hours.
3. Avoid sweet snacks. Ferrets are notorious for their “sweet tooth”. Offering a ferret with insulinoma a sweet snack is similar to a person eating a candy bar. First a “sugar high” occurs and the person feels full of energy, but this is followed by a “crash” or decrease in blood sugar. Ferrets with insulinomas cannot handle these changes, and severe signs of hypoglycemia may occur such as collapse or seizures.
4. Recognize situations that can use blood sugar, such as excitement, exercise, or stress.
  - Limit the amount of time that your ferret rough-houses.
  - Encourage your pet to eat a high-protein, high-quality snack before and after exercise, excitement, and/or stress.
5. If signs of hypoglycemia are observed at home, encourage your pet to eat since this will help to stabilize blood glucose levels.
  - If the ferret will not eat, it may need emergency care.

6. Consider keeping a log to record episodes of hypoglycemia. This will help your veterinarian to evaluate the efficacy of your ferret’s medication(s).
7. Your veterinarian may provide you with an emergency kit and instructions to start care at home if your ferret has a hypoglycemic episode that feeding isn’t resolving. This is especially important if you live far from emergency services.



Syringe feeding ferret

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### Online Resources

Adapted from “Insulinoma in the Ferret” on [LafeberVet.com](http://LafeberVet.com)

Follow AEMV on Facebook ([www.facebook.com/AEMVveterinarians](http://www.facebook.com/AEMVveterinarians)) for exotic companion mammal tips and resources. Our website, [www.aemv.org](http://www.aemv.org), offers a Find-a-Vet tool to help exotic companion mammal owners find veterinarians around the world.

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