

# Ferret Oncology

## Diseases, Diagnostics, and Therapeutics



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### KEYWORDS

- Neoplasia • Neoplasm • *Mustela putorius furo* • Hyperadrenocorticism • Insulinoma
- Lymphoma

### KEY POINTS

- Tumors are commonly seen in ferrets after the age of 3 years, and the endocrine, hemolymphatic, and integumentary systems are most commonly affected.
- The 3 most common tumors in ferrets are adrenal tumors, insulinoma, and lymphoma, making up more than 40% of all tumors seen in ferrets.
- It is extremely common for ferrets to have multiple types of tumors simultaneously; ferrets with up to 4 types of concurrent tumors have been seen.
- Although with surgery a neoplasm can be removed, both adrenal tumors and insulinoma can be managed medically with an even better, or similar, mean survival period compared with surgically managed cases.
- Providing ferrets with a depot gonadotrophin-releasing hormone-containing implant and feeding them a diet with a high protein and fat content and a low carbohydrate content have been suggested as measures to prevent the occurrence of adrenal tumors and insulinoma, respectively; however, proof that these measures work has not been published to date.

### INTRODUCTION

In recent decades it has become clear that the previous conception that neoplasia in ferrets are rare is false.<sup>1</sup> A large range of case reports have been published on a wide variety of tumors, and more information has become available on the most common neoplasia of ferrets. In addition, ferrets have recently been introduced as lung cancer research models in which lung cancer could be induced after exposure to either tobacco smoke or a specific tobacco carcinogen.<sup>2</sup>

Most tumors in ferrets are seen after the age of 3 years.<sup>3–5</sup> The endocrine, hemolymphatic, and integumentary systems are most commonly affected, with adrenocortical

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tumors and insulinoma making up more than 40% of all tumors seen.<sup>4,5</sup> The third most commonly seen neoplasm in ferrets is the lymphoma.<sup>3-5</sup> In up to 20% of ferrets with a tumor, multiple tumors of different origin (up to 4) can be found simultaneously.<sup>3,4,6</sup>

Aside from the 3 common types of neoplasia in ferrets, any other type of tumor may be diagnosed. **Table 1** provides an overview of the different types of spontaneously occurring neoplasia reported in ferrets. For an overview of the general diagnostic and therapeutic options in oncological patients (see van Zeeland's article, "Rabbit Oncology: Diseases, Diagnostics and Therapeutics," in this issue). Examples of the most sophisticated diagnostic techniques available to diagnose oncological disease in ferrets include computed tomography (CT), MRI, and scintigraphy. Although these techniques are not as easily available and are more expensive compared with radiology and ultrasonography, these advanced imaging techniques may enable visualization of masses that otherwise would remain undetected (**Fig. 1**),<sup>16,34</sup> and allow the volume of tissues to be calculated, thereby enabling monitoring of their growth. In addition, CT may help visualize the extent of the tumor and its potential invasiveness in other tissues (**Fig. 2**). Scintigraphy may also help detect neoplasia, whereby the distribution of radiopharmaceutical agents in specific tissues, such as the thyroid gland, can be visualized by using a gamma camera.<sup>43</sup> Specific ferret-related diagnostic and therapeutic options are discussed here in relation to the endocrine, hemolymphatic, and integumentary tumors in this species.

## ENDOCRINE TUMORS

### *Adrenocortical Tumors*

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Hyperadrenocorticism, also referred to as adrenocortical disease or adrenal gland disease, is the most common endocrine tumor seen in ferrets. Although hyperadrenocorticism is considered similar to hypercortisolism (Cushing disease) in dogs, cats, and humans, in ferrets plasma androstenedione, 17 $\alpha$ -hydroxyprogesterone, and estradiol concentrations are increased. In line with the latter three increased hormone concentrations, no atrophy is seen in the nonneoplastic, contralateral adrenal gland.<sup>44</sup> Histologic changes of the adrenal glands range from (nodular) hyperplasia to adenocarcinoma and everything in between. However, an indication of the prognosis based on the histologic diagnosis cannot be given.

#### **Cause**

Although early neutering (at the age of 6 weeks) has long been postulated as the cause for the high prevalence of adrenal tumors in ferrets, it is not likely that the time of neutering is the most important factor in the development of these tumors. It is likely that the increased concentrations of gonadotropins, which occur after neutering because of the loss of negative feedback, persistently stimulate the adrenal cortex, which eventually results in adrenocortical growth. Support for this hypothesis can be found in the fact that luteinizing hormone receptors have been detected in the adrenal glands of ferrets with hyperadrenocorticism. These receptors are considered to be functional, because plasma concentrations of adrenal androgens increase after intravenous injection of a gonadotrophin-releasing hormone (GnRH) agonist.<sup>45</sup> In addition, the depot GnRH agonist, deslorelin, is currently used successfully in managing the clinical signs of ferrets with hyperadrenocorticism.

When ferrets are kept indoors, it is likely that the length of (day)light they receive is longer than that received by ferrets that are housed outdoors. Because gonadotropins are secreted during the time when ferrets are kept in light for longer than 12 hours per day, indoor ferrets are longer under the influence of these hormones and may thus

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