Introduction

Ferret skin is thick, especially around the head and neck, and has a deep subcutis. This can make venipuncture and subcutaneous injections problematic (see Chapters 18 and 21). The skin contains numerous sebaceous glands, causing the hair coat to feel normally slightly greasy and have a characteristic musky odour. In albino animals, sebaceous secretions may cause yellowing of the hair coat with age, especially in intact males. Ferrets also have two prominent perianal scent glands, the contents of which are expelled when the animal is excited or agitated, or in oestrus. Normal ferrets may often have comedones present on the skin of the tail.

The hair coat consists of a thick, usually cream-coloured undercoat and coarse guard hairs that determine coat colour. Ferrets moult in the spring and autumn in response to changing photoperiod and their hair colour may change to a lighter shade in winter. If the coat is clipped or shaved during periods of seasonal hair loss, it may not regrow for several weeks or even months. As hair does regrow in a clipped area, or after specific treatment for alopecic disease, the skin can appear bluish. This is normal but can be mistaken for cyanosis or bruising.

Ferrets do not have well developed sweat glands and this, combined with the thick coat, makes them susceptible to heat stress and heat stroke.

The foot pads are similar to those in dogs and the jill has four pairs of mammary glands and nipples.

Approach to the skin case

The general principles of diagnosing skin disease in cats and dogs are equally applicable to ferrets, and all of the same diagnostic techniques may be used. The diagnostic approach consists of:

- Obtaining a history – general and presenting complaint
- General clinical examination
- Skin examination
- Differential diagnosis
- Specific diagnostic tests
- Definitive diagnosis and appropriate treatment.

History

Important details to obtain are:

- Source and length of time owned
- Source and sex of any companions
- Husbandry – working or pet ferret, outdoor or house ferret, type of housing, flooring, bedding and cleaning regimes
- Diet
- Water presentation – bottle or bowl
- Reproductive status – neutered or intact, in oestrus or not
- Vaccination status (distemper, rabies)
- Ectoparasitic control measures
- Presence of other pets
- General health and previous problems.

For the presenting problem:

- How long has it been present?
- Initial distribution and progression of lesions
- Are any other ferrets affected?
- Are any other pets or the owner affected?
- Is pruritus present?
- Have any parasites been seen?

Clinical examination and diagnostic testing

A thorough clinical examination should always be undertaken (see Chapter 18) before concentrating on the skin lesions. The skin should be carefully examined, visually and by palpation, from head to tail and dorsum to ventrum, including the genitalia. Pinnae and external ear canals can also be examined with an otoscope.

Alopecia is a common presenting sign in the ferret and its distribution should be noted. Examination of the bulbs of plucked hairs can give an indication as to whether anagen (active growth) or telogen (resting phase) hairs are present. Hairs in anagen have a well developed bulb, whereas those in telogen have a club-shaped bulb of solid dry material.

Any lesions should be examined in detail and described in terms of distribution, arrangement, configuration, depth, consistency, quality and colour. The morphology of the lesions should be described as either primary (macule, patch, wheal, vesicle, papule, pustule, nodule, tumour) or secondary (scale, crust, hyperkeratosis, excoriations, ulcer, scar, lichenification, hyperpigmentation, fissure, comedo). Diagnostic procedures for dermatoses are listed in Figure 24.1.
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Parasitic skin disease

Mites

*Sarcopetes scabiei* can occasionally infest ferrets, and causes either generalized alopecia and intense pruritus, or localized lesions of the toes and feet (colloquially known as foot rot). Nails can become deformed and slough. Diagnosis is by skin scrapings but false negative results are common. Treatment is with ivermectin at 0.2–0.4 mg/kg s.c. repeated every 7–14 days for three doses. Affected and in-contact animals should be treated and the environment thoroughly cleaned. As in dogs, the zoonotic aspect is important.

*Otodectes cyanotis*

The ear mite *Otodectes cyanotis* can affect ferrets as well as cats and dogs, and causes chronic irritation and secondary bacterial and yeast infections. The mite can be identified directly via an otoscope or rigid endoscope, or by examining aural debris obtained by a swab, mixed with mineral oil under 40–100X magnification (Figure 24.2). The life cycle of *Otodectes* takes 3 weeks and the mite can persist for 12 days off the host. Systemic ivermectin is very effective.

Selamectin spot-on treatment at 45 mg (a 0.75 ml single-dose tube), applied between the scapulae, has been reported as efficacious and safe in ferrets (Miller and Eage, 2006). Aural topical treatments are often ineffective in ferrets because the ear canal is so small that medication may not penetrate.

*Demodex* spp.

*Demodex* spp. have been reported as a cause of local alopecia and pruritus in two ferrets (Noli *et al.*, 1996) and treatment with amitraz (0.05%) was effective, with no noticeable side effects.

*Lynxacarus mustelae*

The fur mite *Lynxacarus mustelae* has been associated with ulcerative lesions on the face of ferret kits (Schoemaker, 1999). Treatment was successful with permethrin powder, both of the affected animal and of the environment.

Fleas

Cat and dog fleas (*Ctenocephalides* spp.) and *Pulex irritans* can infest ferrets. Mild to intense pruritus can be seen, generally around the neck. Occasionally alopecia occurs on the neck and thorax. Signs of flea-bite hypersensitivity may also be seen in some animals, such as papulocrustous dermatitis over the tail base, ventral abdomen and caudomedial thighs (Fox, 1998). The affected ferret and any in-contact cats and dogs should be treated, along with the environment. Products approved for cats can be used in ferrets. Spray or pump products such as fipronil should be measured carefully and applied to a cloth that is then applied to the ferret, to avoid overdose. Imidacloprid has been used safely and effectively and lufenuron appears to be effective when given at cat dosages (Orcutt, 2004).

Ticks

Ticks can also affect ferrets, especially those used for outdoor hunting. Lyme disease has not been reported. Ticks should be removed manually.

Myiasis

*Cuterebra* larvae can cause subdermal cysts in ferrets and *Hypoderma bovis* larvae can cause...
granulomatous masses in the cervical area, but these are both uncommon. Flystrike is also uncommon in pet ferrets, but has been reported in farmed ferrets and mink, caused by the flesh fly *Wohlfahrtia vigil* (Fox, 1988).

**Bacterial disease**

Bite wounds in ferrets are common, resulting from playing, mating or true fighting. They generally occur in the thick skin around the neck and often become infected with *Staphylococcus*, *Streptococcus*, *Corynebacterium*, *Pasteurella* and *Actinomyces* spp. and *Escherichia coli*, resulting in abscesses, deep pyoderma or cellulitis. Bacterial pyodermatitis can also be secondary to pruritus and self-trauma due to ectoparasite infection. Treatment is by debridement and appropriate antibiotic based on culture and sensitivity. Abscesses may be lanced and flushed, and drains may be placed, or wet to dry dressings employed.

*Actinomyces* spp. can cause ‘lumpy jaw’ lesions in ferrets. Affected animals have nodules or abscesses in the neck that can discharge green–yellow pus. Treatment is by curettage and drainage plus antibiotic. The lesions can respond to high dose penicillin (40,000 IU/kg s.c. q24h) or tetracycline (25 mg/kg orally q24h).

**Fungal disease**

*Ringworm*

*Microsporum canis* is the more common cause of ringworm in ferrets, but *Trichophyton mentagrophytes* is also seen. Young or immunosuppressed animals are generally affected, with typical non-pruritic annular lesions of alopecia, broken hair and scale. Transmission is often from co-housed domestic cats. Diagnosis and treatment are as for other species, with shaving of the affected hair, topical keratolytic shampoos and antifungals such as enilconazole (0.2% solution) usually being effective. Systemic griseofulvin is rarely needed but can be used at 25 mg/kg/day for 21–30 days (Collins, 1987). Orcutt (1997) recommended that complete blood counts are monitored every 2 weeks during treatment. The environment should also be decontaminated if possible by vigorous vacuuming, steam cleaning or the application of dilute bleach or chlorhexidine solution. Spontaneous remission is also reported.

**Other fungal diseases**

* Blastomyces dermatitidis has been reported in one ferret with pneumonia and an ulcerated footpad (Lenhard, 1985). Treatment included oral ketoconazole at 8 mg/kg and intravenous amphotericin B at 0.4–0.8 mg/kg for approximately 1 month. Histoplasmosis and coccidioidomycosis have been diagnosed as the cause of subcutaneous nodules (Scott *et al.*, 2001). Cryptococcosis can cause a wide spectrum of clinical signs (rhinitis, lymphadenitis, pneumonia, pleurisy) but can also cause localized lesions of distal limbs (Malik *et al.*, 2002) (Figure 24.3).
Endocrine disease

Hyperadrenocorticism
This condition occurs commonly in middle-aged ferrets in the USA, associated with adrenocortical hyperplasia, adenoma or adenocarcinoma. Pituitary-dependent hyperadrenocorticism has not been recognized in ferrets. Cutaneous signs include bilateral symmetrical alopecia (Figure 24.5) and vulval swelling in females, which should be differentiated from hyperoestrogenism. Hair is easily epilated and is lost progressively over the perineum, tail, flanks, sides and back. Over 30% of cases may be pruritic. On physical examination, adrenal gland enlargement may be palpated. The aetiology, diagnosis and treatment of adrenal gland disease is described in detail in Chapter 30.

Basal cell tumours have been reported at an incidence of 58% in a study of 57 cutaneous neoplasms submitted from ferrets over a 5-year period (Parker and Picut, 1993). Average age at diagnosis was 5.2 years and 70% of affected animals were female. The appearance is usually of a pedunculated or plaque-like minimally invasive mass that can become ulcerated. Complete excision is usually curative.

Mast cell tumours commonly involve the skin in ferrets and are usually benign. Parker and Picut (1993) reported that mast cell tumours represented 16% of all cutaneous neoplasms submitted from ferrets over a 5-year period. The appearance is usually of single or multiple well circumscribed hairless nodules (Figure 24.6) that can become ulcerated and crusted with a black exudate. Some are pruritic, and oral or topical antihistamines can be used to obtain temporary relief. Surgical excision (Figure 24.7) is generally curative, and premedication with antihistamines or wide surgical margins are not required (Antinoff and Hahn, 2004).

Hyperoestrogenism
This is probably the most common endocrine condition encountered in practice in ferrets in the UK. In these latitudes the normal breeding season for ferrets is between March and September, during which time females are seasonally polyoestrous with induced ovulation. Ovulation occurs approximately 30–40 hours following mating. If unmated or not stimulated to ovulate, as many as 50% of females may develop aplastic anaemia after prolonged oestrus (up to 6 months). High levels of oestrogen lead to oestrogen suppression of the bone marrow and resulting anaemia with pancytopenia. Other causes of hyperoestrogenism include an ovarian remnant following ovariohysterectomy or adrenal neoplasia. Pseudopregnancy following a sterile mating has been recorded in ferrets.

The main cutaneous sign is alopecia, usually starting over the tail base and progressing cranially. Diagnosis, treatment and prevention of hyperoestrogenism are described in detail in Chapter 30.

Neoplasia
Cutaneous neoplasia is relatively common in ferrets and is reported as the third most common form of neoplasia (Li et al., 1995).

Squamous cell carcinoma, adenoma, adenocarcinoma, epitheliotropic cutaneous lymphoma, haemangiosarcoma and fibroma are among other rarer skin tumours reported in this species (Figure 24.8). Perianal apocrine gland adenocarcinoma may also...
be seen. Diagnosis is based on fine-needle aspirates or biopsy. Squamous cell carcinoma is best treated by excision with wide surgical margins, but the use of bleomycin (20 IU/m² once a week) has been reported as temporarily reducing tumour size (Hamilton and Morrison, 1991). Isoretinoin may be useful in the palliative treatment of epitheliomatous lymphoma (Rosenbaum et al., 1996), and prednisolone at 2.5 mg/kg orally twice daily has also been reported as giving symptomatic relief for 6 months post diagnosis in one case (Kelleher, 2001). Radiation therapy can play a role in postoperative management of some cutaneous tumours.

Vaccination site fibrosarcomas

Vaccination site fibrosarcomas (Figure 24.9) have been reported in the ferret. In one study 7 out of 10 dermal or subcutaneous fibrosarcomas were from the intercapsular region, dorsal neck or dorsal thorax (Munday et al., 2003). This is of interest as, until this study, vaccination had not previously been associated with oncogenesis in non-feline species. Wide and deep surgical excision, possibly followed by local radiation, is indicated (Antinoff and Hahn, 2004).

The convention is still to administer vaccines subcutaneously in the interscapular region. Although the number of reports of sarcomas is very small, it may be more prudent to give vaccines subcutaneously in the rear limb, or at least to note on the animal’s records where the vaccine was given. If a mass is still apparent at the inoculation site more than 2 months after vaccination, a recommendation in cats is that it should be removed with wide margins and submitted for histopathology (Professor Danielle Gunn-Moore, personal communication) and this could also be applicable to ferrets.

Chordoma

Ferrets appear to have a relatively high incidence of developing chordoma, mostly at the tip of the tail (see Chapter 30, Figure 30.7), but thoracic, cervical and tail base locations have also been reported. Although not a cutaneous neoplasm, coccygeal chordoma presents as a very slowly expanding mass, usually of the tail tip. Metastasis is rare but has been reported. Treatment is by surgical excision of the affected tail tip, but no treatment is possible if the tumour is located elsewhere along the vertebral column.

Miscellaneous conditions

Musky odour

Ferret skin naturally contains numerous sebaceous glands, which cause the natural musky odour and sometimes greasy feel of the coat. It is not possible to de-scent a ferret, but neutering and feeding of a commercial pelleted diet will help to minimize offensive odours. There is some debate on the regular shampooing of ferrets, with some veterinary surgeons, owners and breeders maintaining that this strips away the sebaceous secretions and stimulates
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their increased production, while others insist that it is highly effective at reducing odour. Excessive bathing can cause dry pruritic skin and, if required, a bathing frequency of not more than once a month is generally recommended by the author. A mild cat or specific ferret shampoo should be used. Male ferrets are always more odiferous and secretions can be so profuse that the coat of albino animals appears yellow and dirty.

Seasonal alopecia
Normal thinning of the coat occurs in both intact and neutered ferrets as days lengthen and the weather warms, and a bilaterally symmetrical alopecia of the tail, perineum and inguinal area can often occur during the breeding season. This effect is usually most pronounced in intact jills and should be distinguished from endocrine disease (see Chapter 30).

Stress
Telogen defluxion can sometimes be seen 2–3 months after a stressful event.

Atopy
Presumptive atopy has been reported (Scott et al., 2001), presenting as symmetrical non-lesional pruritus over the thorax, dorsal tail area and paws and responding to glucocorticoids or chlorphenamine (1–2 mg/kg orally q8–12h). Fleas were absent and hypoaллерgenic diets ineffective.

Food hypersensitivity
One case of food hypersensitivity has been noted and responded well to feeding a commercial hypoallergenic diet for cats (Scott et al., 2001).

Blue ferret syndrome
This is an idiopathic syndrome reported by Burgmann (1991). Ferrets of either sex, neutered or intact, present with a bluish discoloration of the abdominal skin, but are otherwise asymptomatic. The coloration disappears within a few weeks. It is often seen in ferrets clipped for surgery during catagen. The clipped skin area remains hairless and then turns blue and it seems that the hair follicles are manufacturing melanin to be incorporated into growing hairs. Hair regrowth begins within 1–2 weeks after the blue colour appears (Scott et al., 2001).

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