

Parasitic and Fungal Skin Diseases of Dog and Cats - Review on Pathophysiology, Diagnosis and Treatment

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Introduction

The skin is the largest organ of the body with many different functions as thermoregulation, immune protection, sensory perception, vitamin D production and it acts as a barrier between the animal and the environment. Besides all of these important functions and the diseases that affect directly the skin, it may also share or reflect pathologic processes from other tissues. Due to these characteristics, dermatologic problems are among the most commonly seen disorders in veterinary hospitals. It is important for the veterinarian to know and understand about the physiology of the most common dermatologic disorders that affects dogs and cats and its treatment.

Parasitic Skin Diseases

Demodicosis

Demodicosis is a very common skin disease in dogs but rare in cats. It is an inflammatory disease, in which large amounts of *Demodex* mites are found in the skin. Mites proliferate in the hair follicles and sebaceous glands causing the disease. Mueller *et al.* (2011) found that it is a common condition and it is often serious in dogs. Besides *Demodex canis*, two less common species were reported *Demodex sp. cornei* and *Demodex injai*.

Feline demodicosis may be caused by two different kinds of mites, *Demodex cati* and *Demodex gatoi*. Mueller (2004) stated that the mites are transferred from the mother to the offspring in the early life. *D. canis* is considered a commensal in canine skin. It is believed that this disease is a consequence of a specific immunosuppression, which allows the proliferation of the mites. Genetic factors are probably very important in the development of generalized disease and therefore, breeding of affected animals is contraindicated (May *et al.* 2006).

Erythema, comedones, scaling, partial or complete alopecia, papules, follicular casts, pustules, and in severe cases, furunculosis, crusting, exudation and ulceration with focal draining tracts can be clinical signs. According to May *et al.* (2006) the lesions begin on the face and limbs, but they may become generalized. Demodicosis can be classified into generalized or localized. The involvement of one complete body region, five or more focal areas, or the involvement of the legs is considered generalized demodicosis (Mueller, 2004).

The diagnosis is made by deep skin scrapings or trichogram. In some rare cases, in the legs or certain breeds such as Sharpeis, these tests may be negative,

requiring biopsies for mite detection. In most dogs, localized demodicosis resolves spontaneously, thus mite-specific therapy is not necessary until the disease generalizes.

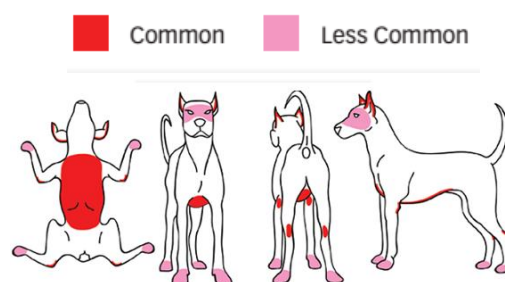
The treatment of generalized demodicosis involves several approaches. In addition to the acaricidal treatment, the concurrent secondary infections and underlying diseases should be also accessed. As an acaricidal treatment, ivermectin is recommended at 0.3 to 0.6 mg/kg orally once a day, however, it is recommended to begin the treatment with a lower dose and gradually increase the amount of drug administered (Mueller *et al.* 2011)

The animal should be monitored for the appearance of adverse effects. Therapy with moxidectin 0.2-0.5 mg/kg orally once a day and doramectin 0.6 mg/kg orally or subcutaneously once a week were proven effective in the treatment of generalized demodicosis (Mueller, 2004). The same careful institution of a gradual dose taken with ivermectin should be applied for these two other drugs. Milbemycin oxime can also be used at 1 to 2 mg/kg orally, once a day, with good results. In cats weekly baths with 2% lime sulfur are indicated for the treatment of demodicosis. There is remote evidence to indicate weekly application of 0.025% amitraz and for the use of doramectin 0.6 mg/kg once a week subcutaneously. Treatment should continue for one month after getting the third consecutive negative scraping.

Canine scabies

Canine scabies is a common condition in dogs and humans, but rare in cats, in which the skin is colonized by *Sarcoptes scabiei* mite after contact with a donor host. The infestation with this mites results in intense pruritus (Diwakar and Diwakar, 2017). Female mites dig galleries in the stratum corneum in order to lay their eggs that hatch, releasing larvae forms that migrate to the skin surface, where they reach the adult stage. Six *et al.* (2000) state that extremely irritating and pruritic papular eruption, skin thickening, erythema, alopecia, exudation with crust formation and secondary bacterial infection with pustules are common clinical findings. Chronic lesions are usually confined to the margins of the pinna, elbows and hocks that may present skin thickening, minimal crust formation and persistent pruritus.

Distribution Pattern of Diseases for Canine Scabies



Diwakar and Diwakar (2017) opined that the skin scraping with microscopic identification of *S. scabiei* is a valuable diagnostic method, although mites are hardly seen in many cases. Diagnosis is usually based on the animal's history, clinical signs and a positive pinnal-pedal reflex (pinna marings are

gently scratched and the dog will reflexively use an ipsilateral hind limb to scratch the source of the irritation).

The treatment is recommended to the patient and other animals in their household. Bathing with 0.025% amitraz solution once weekly or twice weekly is recommended as an effective treatment. The therapy should be continued for two weeks after clinical signs remission (Six *et al.*, 2000). Adverse side effects should be monitored during the treatment. Fipronil spray 0.25% can be applied three times with three weeks intervals on puppies.

Ivermectin can be administered at 0.2 to 0.4 mg/kg, orally every seven days, or subcutaneously every 14 days. The treatment usually takes four to six weeks. This drug is contraindicated in Collies and their crosses. An effective alternative treatment of scabies is a spot-on application of selamectin at 6-12 mg/kg every 15 to 30 days, for at least three applications and it is apparently, well tolerated in different breeds. Milbemycin oxime at 2mg/kg in a weekly dose, administered for up to five times has also a good efficacy.

Fungal diseases

Dermatophytosis

Dermatophytosis is a superficial mycosis caused by *Microsporum*, *Trichophyton* or *Epidermophyton* fungi genera. Hainer (2003) opined that these fungi are isolated from hair, nails and skin surface since they require keratin for their growth. Dermatophytes are classified into three groups based on their habitat: zoophilic, mostly found in animals,

occurring transmission to other animals or to humans; anthropophilic, mostly found in humans, transmitted between humans and rarely to animals and geophilic, dermatophytes, found in the soil, infects humans and animals (Bond,2010).

M. canis is the most frequently isolated fungal species in dogs and cats. Clinically, canine and feline fungal infections differ. Moriello and Newbury (2006) observed that the infections in dogs often produce lesions, while it is possible to isolate dermatophytes from clinically healthy cats, which can act as a conidia reservoir of the fungus. The affected animals usually have alopecic, scaly, crusted, erythematous and papular lesions, especially in the face and limbs. Occasionally, dermatophytes may be presented in a nodular form known as kerions. This form of dermatophytosis is characterized by deep, inflammatory and suppurative lesions. Pruritus may vary from absent to severe.

The direct microscopic examination of hairs and scales can reveal the presence of fungal hyphae or spores. The fungal culture is the diagnostic test of choice and the sample may be obtained by brushing the animal with a toothbrush or by skin scrapings.

The best strategy for the treatment of dermatophytes is the association of systemic and topical antifungal therapy. The aims of the treatment with topical products are the elimination of the fungi present at the epidermis and hair surface, while systemic treatment aims to eliminate infection within the hair shafts. Newbury *et al.* (2007) suggested that the Lime sulfur

rinse at 6.5 % twice a week showed good results in cats infected with *M. canis*. Systemic treatment options include itraconazole orally at 10 mg/kg once a day, griseofulvin 50 mg/kg once a day or terbinafine 5 mg/kg once a day (Tonatiuh et al.2004) The treatment must be extended over 2 to 4 weeks after clinical cure and after obtaining two or more negative fungal cultures (Moriello, 2004).

Sporotrichosis

Sporotrichosis is a subcutaneous mycosis caused by a dimorphic fungus, *Sporothrix schenckii*, which can infect animals and humans. It is a zoonotic disease and transmission to humans occurs through bites or scratches, and contact with cats ulcers. *S. schenckii* is present in the decaying vegetation and soil and animal contamination occurs by skin open lesions such as perforations, bites and scratches (Welsh, 2003). Once in the host organism, the fungus may cause local lesions and possibly systemic signs.

Clinically, sporotrichosis has three forms: cutaneous, lymphocutaneous and generalized, and more than one form can occur simultaneously in the same animal. The cutaneous form is usually confined to the area of fungus inoculation and manifests after an incubation period of one month (Cagnini ,2012). If this lesion is not treated, the progression to lymphocutaneous form can occur. According to Welsh (2003), the lymphocutaneous form is characterized by the development of nodules that evolve into ulcers, affecting skin, subcutaneous tissue, lymph vessels and regional lymph

nodes. History of lethargy, anorexia, depression and fever on physical examination suggest the presence of the disseminated form.

The diagnosis is based on clinical history, physical examination, cytological evaluation, fungal culture and histopathological findings. As per the suggestions given by Cagnini (2012) denoted that cytological evaluation usually reveals oval to elongate yeast cells consistent with *S. schenckii* form and inflammatory cells may also be present. On histopathology, the presence of deep pyogranulomatous dermatitis, cellular infiltration of polymorphonuclear and mononuclear cells, and the presence of PAS positive structures compatible with *S. schenckii* may be observed. Oral administration of itraconazole 10 mg/kg every 24 hours is the treatment of choice.

Cryptococcosis

Cryptococcus spp. is a saprophytic fungus present in the environment and in the feces of pigeons, capable of causing systemic infection in dogs and cats, with a higher incidence in felines. The species of interest in veterinary medicine are *C. neoformans*, which has a global distribution and *C. gattii* that has a limited distribution. *C. neoformans* typically infects animals by inhalation and may cause ophthalmic, upper respiratory tract and central nervous system lesions (Chiesa, et al. 2004).

Ulcerative lesions in the nasal, oral or pharyngeal mucosae, or a nasal masse may be present. Mycotic rhinitis and cutaneous nasal bridge and nasal plan

involvement are the most frequent findings. In cats with positive serology for feline immunodeficiency virus (FIV) cryptococcosis tends to manifest itself in a disseminated or advanced form. Cryptococcosis diagnosis is based on fungal culture, cytological, histological and serological exams.

Cytological examination may reveal the presence of leukocytes, macrophages and numerous encapsulated structures (yeast) of different sizes. Drug therapy leads to patient healing in most cases and it consists of oral antifungal use until complete remission of clinical signs, usually in 3 to 12 months. It is strongly recommended not to interrupt the treatment until the titers of antibodies against cryptococcosis are reduced to zero. Drugs commonly used include fluconazole 50 mg/cat every 12 hours and itraconazole 50-100 mg/cat every 24 hours, or 10mg/kg for dogs and cats every 24 hours (Trivedi *et al.* 2011) Patients with nasopharyngeal masses benefit from surgical resection, for upper airway patency and reduction of infected tissue to be treated medically.

Malassezia dermatitis

Malassezia pachydermatis is a commensal skin yeast, commonly isolated from lips, interdigital skin, anal mucosa and external auditory canal. It is an opportunistic yeast, which usually manifests itself after the installation of other diseases (Machado *et al.* 2011). It is very common in dogs and least frequent in cats. Ihrke (2008) revealed that the previous antibiotic therapy is associated with the development of cutaneous M.

pachydermatis over growth in dogs, as well as disorders of keratinization and hypersensitivity diseases.

Basset Hounds, Cocker Spaniels and West Highland White Terriers are more predisposed to this type of infection. The most common clinical manifestation of *Malassezia dermatitis* is the presence of moderate to intense pruritus. Erythema, lichenification, oily skin, malodor, alopecia and erosions are also common clinical findings that can be generalized or localized.

Cytology is the diagnostic method of choice and allows microscopic identification of the increased number of yeasts. Samples can be obtained by skin scrapings, swabs, direct imprint or by tape preps. Fungal culture is not recommended as a diagnostic procedure because it is not a quantitative assessment. Identification and correction of the predisposing diseases are essential for the successful treatment of *Malassezia dermatitis*. Mild cases can be treated with miconazole, chlorhexidine, ketoconazole or acetic acid shampoos. Baths should be given, two times per week, for a minimum of six weeks.

Patients requiring systemic treatment should receive oral anti fungals such as ketoconazole, itraconazole or fluconazole 5 mg/kg once a day for a minimum of 30 days. Terbinafine 30 mg /kg every 24 hours on two consecutive days in a week, for six weeks, may also be an effective treatment. In order to prevent recurrences of the disease, regular maintenance therapy may be needed in many dogs.

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