

Diagnosis of atopic dermatitis in dogs

Masahiko Nagata DVM, MS

Dermatologist, Animal Dermatology Centre, ASC, Tokyo, Japan

KEY POINTS

- Atopic dermatitis is very common in dogs and some breeds are particularly predisposed to the condition.
- The most common clinical sign is pruritus at an early age, especially of the face, ears, ventral abdomen and feet.
- A diagnosis of atopy can be made by systematically excluding the differential diagnoses.
- Allergy tests are not a substitute for history, physical examination and careful elimination of other diagnosis.

Introduction

It has been estimated that 20–75% of small animals seen in the average practice have skin problems as the main or concurrent complaint (1). In 1998, a nationwide survey in Japan revealed that canine skin disorders were one of the most common reasons for visits to the veterinary clinic (2). The survey also revealed that the most common groups of canine skin disorders are infections and allergic diseases, and that the most common final diagnoses, in descending order of incidence, are flea allergic dermatitis (FAD), pyoderma, otitis externa, atopic dermatitis (AD) and seborrhoeic dermatitis (2). The survey indicated that allergic skin disorders, especially FAD and AD, are quite frequently encountered at the veterinary clinic and that AD is undoubtedly a more complicated disorder than FAD. This paper will therefore focus on canine AD and discuss the aetiology, clinical features and diagnosis. Dr Harvey and Dr Markwell discuss the management of AD in this issue of *Focus* (see pages 10-15).

What is atopic dermatitis?

AD may be defined as a chronic relapsing skin disease that occurs most

commonly during the early years of life. It is frequently associated with elevated serum IgE levels (3). In dogs, AD was historically described as pruritic dermatitis associated with the inhalation of pollen, or fungal and environmental allergens. However, the respiratory route of exposure, although plausible, is difficult to relate to the clinical picture where the most commonly affected sites are the face, external ear canals, ventral abdomen, distal limbs and feet (4). Some degree of percutaneous allergen transfer seems probable, particularly in areas in contact with the environment and areas that are subject to continuous microtrauma (4). Strong breed predilections, familial involvement and limited breeding trials have demonstrated that canine AD also seems to be genetically programmed (5). Finally, although elevated concentrations of allergen-specific IgE have been classically associated with the disease, a large body of literature also supports the importance of allergen-specific IgG (5, 6). This may be one reason why both intradermal skin tests and *in vitro* IgE enzyme-linked immunoassay (ELISA) give occasional false negative results.

The mechanisms responsible for inflammation in AD have not been fully elucidated in either humans or dogs, but a number of interdependent factors are suspected to be involved, such as antigen exposure, allergen-induced IgE synthesis, T-helper lymphocyte dysfunction and mast cell degranulation (7). In addition, it is entirely possible that atopic individuals



Masahiko Nagata
DVM, MS

Dr. Masahiko Nagata graduated from Nihon University, College of Veterinary Medicine in 1985 with a M.S. degree. He was a general practitioner for 3 years. He then attended Cornell University from 1988 to 1989 and Nippon Veterinary and Zootechnical University from 1990 to 1995 for dermatology training. He started a dermatology office in 1998. Today he is the only dermatologist with a referral clinic in Japan, and is also an adjunct professor at Nihon

Table 1

Examples of breeds predisposed to atopic dermatitis (breed predisposition may vary from region to region)

Boxer	Irish Setter
Belgian Tervuren	Golden Retriever
Boston Terrier	Labrador Retriever
Cairn Terrier	Newfoundland
Scottish Terrier	German Shepherd
West Highland White Terrier	Lhasa Apso
Wirehaired Fox Terrier	Shih Tzu
American Cocker Spaniel	Miniature Schnauzer
Chinese Shar Pei	Pug
Dalmatian	Miniature Poodle
English Bulldog	Shiba Inu
English Setter	



Figure 1
Dog with acute AD. Note hypotrichosis without apparent inflammatory skin lesions due to severe pruritus on the ventral trunk.



Figure 2
Dog with chronic AD. Note lichenification, hyperpigmentation, and alopecia due to severe pruritus on the ventral abdomen.



Figure 3
Dog with AD. Note oedematous erythema with excoriation around the eyes.



Figure 4
Dog with AD. Note oedematous erythema with excoriation on and around the lips.

Table 2

Diagnostic criteria of canine atopic dermatitis, according to Willemse (4, 9)

Major features

- Pruritus
- Facial or digital involvement
- Lichenification of the flexor surface of the tarsal joint or the extensor surface of the carpal joint
- Chronic or chronically relapsing dermatitis
- Individual or family history of atopy
- Breed predisposition

Minor features

- Onset of symptoms before the age of three years
- Immediate skin test reactivity to inhalant allergens
- Elevated serum concentrations of allergen-specific IgGd
- Elevated serum concentrations of allergen-specific IgE
- Xerosis
- Recurrent superficial staphylococcal pyoderma
- Recurrent *Malassezia pachydermatis* infection
- Recurrent bilateral otitis externa
- Bilateral recurrent conjunctivitis
- Facial erythema and cheilitis (sore lips)
- Sweating

have skin with a reduced threshold for pruritus (4, 5). Clinically, this is supported by the observation that numerous allergens, infections, ectoparasites, reduced humidity, excessive greasy scale, heat and obsessive-compulsive disorder can exacerbate pruritus and scratching in both humans and dogs.

Clinical features of canine atopic dermatitis

Canine AD can be recognised in any breed or cross-breeds. Breed predilections vary with geographic location and time. However, many reports have indicated that the disease is more frequent in certain breeds (Table 1), although cross-bred dogs may also be affected (2, 4, 5, 8).

Dogs with AD typically begin to exhibit pruritus between one and three years of age, although there may be individual and breed variation in age of onset. Thus, the age of onset is much earlier in certain breeds, such as

Chinese Shar Peis and Golden Retrievers, and much later in cross-breeds. The atopic status of the parents seems to be as important as the local environment, vis à vis the potential to develop AD. In many dogs, clinical signs initially are summer seasonal exacerbated, but some 75% eventually become perennially affected, reflecting the importance of house dust mite allergen in the aetiology of the disease.

The skin reaction pattern and the distribution of the lesions vary according to the breed, individual and clinical course. Acute skin lesions are characterised by intensive pruritus usually associated with excoriations and/or salivary staining (Figure 1). Chronic AD is characterised by alopecia, hyperpigmentation and lichenification, particularly in the predilection areas (Figure 2). In addition, secondary bacterial and malassezian infections are common complications. Pruritus and, consequently, the lesions usually involve the face (around the eyes, lips, muzzle), external ear canals, the flexural folds of the distal extremities and plantar interdigitae, or some combination thereof (Figures 3–6). Dogs also develop lesions on the ventral abdomen, axillae, groin and perineum. A small percentage (about 5%) may exhibit chronic otitis externa as the main clinical sign of their disease.

Diagnosis of canine atopic dermatitis

There is no single distinguishing feature of AD nor a simple, definitive, diagnostic laboratory test. Thus, diagnosis is based on the history, the constellation of clinical findings and the exclusion of the differential diagnoses. Willemse proposed certain diagnostic criteria of canine AD (9), subsequently modified by Reedy, Miller, and Willemse (Table 2) (4). These criteria help to determine whether a patient has AD while not excluding an alternative diagnosis. The major criteria are necessary for the diagnosis of AD, and the minor criteria are supportive of a diagnosis. However, none of the criteria is exclusive to AD. Diagnosis of AD is achieved by excluding the differentials from the list of potential diagnoses (see below).

It is worth noting that positive reactions to allergy testing are minor criteria. The purpose of allergy testing is to try to identify allergens for the purpose of immunotherapy. Two methods of allergy testing are available to practitioners. Intradermal skin testing (IDST) has been performed for many years and is regarded by some as the definitive test for allergen



Figure 5 Dog with AD. Note hypotrichosis without apparent inflammatory skin lesions due to severe pruritus on the flexor surface of the carpal joint.



Figure 6 Dog with AD. Note erythema on the pinna.



Figure 7 Dog with pyoderma. Note papules and pustules on the ventral abdomen.

identification. More recently, measurement of allergen-specific IgE antibodies (using *in vitro* ELISA testing) have become commercially available. IDST is thought to be superior to *in vitro* testing, because of the very common occurrence of false-positive reactions obtained in ELISA systems (4, 5). Allergen sensitivity varies from region to region, partly as a consequence of the local gene pool and partly due to local allergens. Thus, multiple sensitivities to allergens, particularly pollens, are common in the USA, whereas in Europe and Japan it is the house dust mite *Dermatophagoides farinae* that predominates (4, 10).

Differential diagnosis of canine atopic dermatitis

Differential diagnosis of canine AD includes the following common pruritic dermatoses:

- Pyoderma
- Scabies
- Flea bite hypersensitivity
- Food sensitivity
- *Malassezia pachydermatis* dermatitis
- Disorders of keratinisation
- Demodicosis
- Psychodermatoses

The only reliable approach to diagnosing AD is to rule out the potential differential diagnoses one by one – there is no short cut.

Pyoderma

Staphylococcus intermedius is the bacterium most frequently isolated from clinical cases of canine pyoderma. Pyoderma should always be considered as a secondary clinical manifestation of an underlying disorder, such as hypersensitivity, ectoparasite infestation, endocrinopathy or a defect in keratinisation [Mason, *WALTHAM Focus* 1997; 7(4) Canine superficial pyoderma]. Very occasionally, a dog may develop seasonal pyoderma associated with environmental factors, such as increased temperature and humidity, with oestrus or when hunting.

The most common lesions associated with pyoderma are papules, pustules, erythema, epidermal collarettes and focal alopecia (**Figure 7**). The primary lesions (papules and pustules) are transient and most cases exhibit varying degrees of scale, crust and hyperpigmentation. Although pyoderma may be present on any part of the body, it is usually found on the ventral abdomen and proximal limbs in dogs with AD.

Scabies

The vast majority of dogs with scabies are characterised by severe, papular, non-seasonal, steroid-refractory pruritus, accompanied by marked self-excoriation (**Figure 8**). Dogs may exhibit significant peripheral lymphadenopathy and a peripheral eosinophilia. The diagnosis of scabies can be difficult because the pruritus is out of proportion compared with the number of mites. Furthermore, the recovery of mites in skin scrapings is difficult, partly because of scale and crust production, which makes examination difficult.

It is believed that dogs with scabies develop hypersensitivity reactions to mites, which accounts for the degree of pruritus. In addition, the scabies allergen cross-reacts with that of the house dust mite *D. farinae* (11). Because of the difficulty in defining the diagnosis by documenting the presence of mites, clinicians are faced with two options – test therapy or documenting an elevated titre to scabies antigen in the serum.

On rare occasions, clinicians may diagnose a peculiar variant of scabies, so-called Norwegian scabies, which is believed to result from immunodysfunction (12). It is characterised by the presence of massive

numbers of mites and marked scaling and crusting, rather than self-excoriation. Pruritus is usually mild or absent.

Scabies is highly contagious to other dogs and 40% of owners will also develop lesions.

Flea bite hypersensitivity

Fleas are one of the most important parasites that bite dogs and cats [Fisher, *WALTHAM Focus* 1999; 9(2) Advances in the understanding of fleas and their control]. Skin disorders associated with fleas probably reflect a focal reaction at the bite site (13). Flea bite sensitivity is an allergic reaction to flea saliva. There is not always a direct relationship between the number of fleas and the severity of the reaction. In a very allergic patient, just a few fleas can produce severe pruritus. The most common age of onset is between three and five years. The most commonly affected regions of the body are the dorsal lumbosacral region of the back, the base of the tail, the caudal and medial thighs and the inguinal region (Figure 9).

The diagnosis of flea-associated skin disease is achieved by noting compatible clinical signs and the presence of fleas or flea faeces. However, the diagnosis can only be confirmed by noting a good response to flea control. Dogs with AD are predisposed to develop flea allergy.

Dietary intolerance

The term food allergy implies an abnormal or exaggerated immunological response to the ingestion of specific food allergens. Food intolerance, in contrast, describes an abnormal physiological response to ingested food, or a food additive, but makes no claim as to aetiology. Given that it is very difficult to definitively diagnose food allergy, the term 'food intolerance' is preferred.

Clinical signs of food intolerance are variable (14), and the features are often indistinguishable from those seen with AD. The most typical feature is non-seasonal pruritus. Some cases exhibit concurrent gastrointestinal signs, such as flatus, borborygmus, or subtle bowel changes. Some animals with food intolerance may not respond to glucocorticoid therapy, in contrast to dogs with AD (14).

Definitive diagnosis depends on noting a response to a novel diet, and subsequently observing deterioration and alleviation of the clinical signs in response to challenge and provocation studies. Note that many cases of AD show some response to 'hypoallergenic diets' even though they do not have food intolerance. Thus, in a study of dogs with allergic dermatitis (excluding flea allergic dermatitis), 45.7% of the dogs were improved using a commercial elimination diet, PEDIGREE® Selected Protein Diet (chicken and rice) (15). Of the dogs that improved, 68.8% were finally diagnosed as AD. The mechanism of this response is not known, but it can be useful in the management of atopic dogs. Harvey and Markwell discuss further the management of atopic dogs in this issue of *Focus* (see pages 10–15).

Malassezia pachydermatis dermatitis

Malassezia pachydermatis, a lipophilic yeast, is a member of the normal cutaneous flora in warm-blooded animals (16). Malassezian dermatitis is an inflammatory disorder caused by the proliferation of the organism in dogs (17). Although the pathogenic role of *Malassezia pachydermatis* is unknown, the organism is often associated with severe, erythematous, scaling, greasy, steroid-refractory pruritus [Bond, *WALTHAM Focus* 1997; 7(2) *Malassezia pachydermatis* and canine skin disease]. Although cytological techniques, such as tape stripping, may be used for assessing the numbers of yeast on the skin surface, a definitive diagnosis of malassezian dermatitis is only possible by assessing response to trial therapy. Topical shampoos containing antimycotic agents, particularly azole derivatives (e.g. miconazole, ketoconazole), are effective treatments.



Figure 8 Dog with scabies. Note several patches of erythema and hypotrichosis due to severe pruritus on the ventral trunk and extremities.



Figure 9 Dog with flea bite sensitivity. Note hypotrichosis due to severe pruritus on the lower back.



Figure 10 Dog with primary seborrhea. Note greasy skin and patchy hair coat in this Schnauzer-type dog.



Figure 11 Dog with seborrhoeic dermatitis. Note the alopecia, erythema, marginal scaling and lichenification.



Figure 12 Dog with keratinisation disorder. Note the fine, dry scales on the dorsal trunk.



Figure 13 Dog with demodicosis. Note extensive erythema and hair in a pattern consistent with atopy.



Figure 14 Dog with compulsive disorder due to conflict. Note self-inflicted hypotrichosis due to excessive licking of the flexor surface of the elbow joint and the medial forearm.

Disorders of keratinisation

Defects in keratinisation may be secondary or primary. The skin disorder may reflect a congenital error in the control of the process in keratinisation, in which case it may be termed primary seborrhoea.

Much more commonly, the defect in keratinisation is secondary and reflects an underlying disorder, such as allergy, endocrinopathy, or bacteria, yeast or ectoparasite infections. The primary disorder is most commonly seen in certain breeds such as American Cocker Spaniels, English Springer Spaniels, West Highland White Terriers, Dobermann Pinschers and Shih Tzus. In the primary keratinisation defect seen in Cocker Spaniels, for example, there are abnormalities of cellular kinetics in the sebaceous gland, the hair follicle and the basal layer of the epidermis (18). Whether such changes occur in other breeds is not known, although it seems probable.

The clinical spectrum of the disease is variable. There may be greasy skin and hair, (primary seborrhoea) (**Figure 11**), or an accumulation on the skin of dry scales (**Figure 12**) or thick crusts. Secondary bacterial and yeast infection will complicate these changes.

Note that primary defects and secondary defects ultimately exert similar effects on the various components of the skin and produce similar changes in the skin. Thus, a Cocker Spaniel with a primary defect in keratinisation may be greasy, smelly and pruritic, or just exhibit dryish scale, alopecia and recurrent pyoderma. Similarly, a Cocker Spaniel, or a Basset Hound, for example, with essentially normal skin but with food allergy

or malassezial dermatitis may be just as greasy, smelly and pruritic.

The clinician should be especially careful when dealing with individuals from predisposed breeds. Overdiagnosis of primary defects can condemn an animal to years of symptomatic therapy.

Demodicosis

In dogs, demodicosis is a parasitic disease characterised by the presence of excessive numbers of demodectic mites [Ginel, *WALTHAM Focus* 1996; 6(2) Canine demodicosis]. Demodicosis is not considered a contagious disease, because demodectic mites normally inhabit the hair follicles and the sebaceous glands (19). Their proliferation may be related to a skin barrier dysfunction. The disease is most commonly encountered in dogs under one year of age. The focal form of the lesion usually occurs as round patches of alopecia with a normal or slightly scaling surface on the face and/or distal extremities. The localised form of the lesion usually causes more diffuse hypotrichosis with slight scaling erythema, and this form, particularly if beginning to generalise, may be associated with pruritus (**Figure 13**). The generalised form presents as a chronic dermatitis with diffuse alopecia, oedematous erythema, scaling and/or comedones, irregular pigmented maculae, crust formation with prudent exudate, and/or cellulitis. Demodicosis is diagnosed clinically with hair examinations and skin scrapings. Skin biopsy, however, is the most useful tool for making a definitive diagnosis of the disorder.

Psychodermatoses

Psychodermatoses reflect an abnormal psyche, typically exhibiting an obsessive-compulsive syndrome. This is characterised by repetitive behaviour that serves no obvious purpose in the context in which it is performed, and may reflect conflict and frustration (**Figure 14**) (20). The diagnosis is based on exclusion of differentials and response to trial therapy with clomipramine, diazepam or phenobarbitone. The lesions reflect self-trauma and do not respond to systemic glucocorticoids. A genetic predisposition (20) is believed to exist in certain breeds of dog – for example, Dobermann Pinschers, Golden Retrievers, Labrador Retrievers, German Shepherd Dogs, Dalmatians, West Highland White Terriers, Shih Tzus, and Shiba Inu. It should be noted that a dog may suffer concurrently from compulsive disorder and another, co-existent disease, such as infection, keratinisation disorder, allergy or endocrinopathy.

Conclusion

The clinical manifestations of canine AD reflect a multifactorial disorder, which can be complicated by self-trauma or secondary infection. It cannot be over-emphasised that allergy tests are never a substitute for meticulous history, thorough physical examination and careful elimination of other diagnoses.

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