

REVIEW

Dog allergy: understanding our 'best friend'?

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Sensitivity to dogs is a frequent cause of allergic symptoms in atopic patients and often poses a dilemma for both patient and physician. Although strict avoidance is probably the best way to limit allergic symptoms related to dog allergy, patients may be unwilling or unable to completely avoid exposure to dogs. Allergists must weigh the emotional, psychological and possible physical health benefits of dog companionship and the impact of removing a dog from a home vs the adverse health effects that may result from continued exposure to the animal. The purpose of this review is to summarize what is known about dog allergy and to offer insight into a sensible management strategy.

Background

Dog ownership is common worldwide with ≈ 50 million dogs in the US alone [1]. It is no coincidence that atopic individuals are exposed, become sensitized and develop symptoms with subsequent exposures. The true prevalence of allergy to dog is unknown, but positive skin tests have been found in $\approx 6\%$ of children with respiratory tract symptoms [1] and 35% of asthmatics [1]. Several studies have suggested a correlation between the presence of dog antigen in homes and an increased frequency of asthma [1–6].

Although homes without dogs have decreased antigen levels compared with homes with dogs [7], many other studies suggest that complete avoidance of dog antigen may not be possible. Dog antigen can be found in up to 100% of household dust samples from allergic patients [8]. Significant levels of dog antigens can also be found in schools [9, 10]. In one study, dust from school chairs showed very high levels of dog antigen with ≈ 2 –20 times more *Canis familiaris* (Can f 1) than *Felis domesticus* (Fel d 1) (the major cat antigen) [10]. Another study revealed that a significant amount of dog antigens exists even in homes where no dog has lived and that increasing IgE levels to dog antigens occur even in subjects who completely avoid contact with dogs [11]. A recent study by Platts-Mills *et al.* has shown that even in environments free of dust mite and cockroach antigens, schoolchildren are still atopic and

these children have a high prevalence of IgE antibody to dog and cat antigens [6]. Although most homes evaluated in this study had animals, the level of antigen was also high in houses without animals. In addition, there was no clear correlation between sensitization or symptoms and current level of allergen in individual homes. These studies suggest that the consultant's usual recommendation to remove the animal from the home may not prevent exposure to dog allergens and allergic symptoms in sensitive subjects.

General considerations

Specific antigens

As many as 29 antigens found in dog dander and serum have been described as possibly allergenic to humans [12]. Several of these antigens are crossreactive between different breeds and some are crossreactive with other species including cats [13–16]. Antigen 13 or Can f 1 is the major antigen producing IgE antibodies and symptoms [17–19]. Other antigens including antigen 3 and dog serum albumin are also considered to be important [17, 20–22].

Although breed specific antigens may exist [23, 24], the clinical significance of these antigens is unclear. Extracts made of 'mixed' breeds rarely give negative radioallergo-sorbent test (RAST) results in individuals suspected to be allergic to dogs, whereas extracts made from purebred animals may lack antigens relevant to other dog breeds [25].

Animal factors

There are several sources of dog specific antigens including 'danders' or 'epidermals', urine, saliva, blood and faeces. Although there is some debate as to which source is most important or antigenic, from a practical standpoint, dander is the most likely source of exposure and therefore the most clinically relevant. Dander is composed of small scales from the skin and hair capable of producing allergic reactions in susceptible individuals [26].

All dogs possess protein antigens that are known to produce allergic reactions in humans. Even breeds that are described as 'hairless' still have antigens found in dander from skin sources. Although anecdotal reports describe hair length as somehow important, there are no scientific data to

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support these claims. It is possible that longer hair may harbour other environmental antigens such as dust mite, pollens, and moulds to which a patient may also be sensitive. Patients may also be reactive to other substances found on the dog such as pyrethrum containing flea powder or soaps. It is also possible that shorter haired animals may be easier to groom, the importance of which will be discussed later.

With dander being the most likely allergen source, factors that either increase dander production or cause excessive 'shedding' of hair or skin should be considered. For example, dogs with dermatological conditions such as flea allergy, atopic dermatitis, and various skin infections are more likely to have increased dander production [27] and therefore require special attention from both owner and veterinarian. Poor nutrition, poor general health, hormonal factors and even environmental factors may also contribute to increased dander production [27]. There is no scientific data describing specific breed types and levels of dander production.

Maintaining the dog's health is an essential part of controlling dander production. This includes providing adequate nutrition and appropriate veterinary care when necessary. Proper grooming techniques for particular dog breeds can be obtained from most veterinarians and groomers. Routine and proper grooming, preferably outdoors, has been shown to greatly decrease shedding of hair [28] and may decrease skin irritation and secondary bacterial infection [28]. Grooming, preferably by someone other than the sensitive individual, should therefore be an important part of a management strategy for dog-allergic patients. Commercial agents designed to 'cleanse' the dog and remove antigens such as dander and saliva have thus far not been shown to be useful in decreasing symptoms in patients with dog allergy. It is possible that these agents may not decrease antigen exposure more than simple good grooming habits and that the possible irritant effects of cleansing agents may in fact increase dander production. Air filters may decrease airborne allergens but have thus far not been proven to be effective in reducing symptoms related to dog allergy.

Diagnostic and therapeutic considerations

The clinical picture of an individual with sensitivity to dog is similar to that seen with exposure to other common inhalants. Rhinitis, conjunctivitis and asthma are by far the most common problems associated with exposure to dogs. Urticaria and atopic dermatitis have also been attributed to exposure to dogs [26, 29].

Symptoms of dog allergy can be immediate (within minutes) or may be delayed for many hours. Due to the ubiquitous nature of the antigen and the chronic symptoms that may be present, it is often difficult to establish a direct

cause and effect. A careful history is therefore essential to help establish a suspected diagnosis. If a patient's history and physical examination suggest a possible dog allergy, further objective testing is indicated to confirm the diagnosis.

Although a number of studies have attempted to address the issue of which tests are the most useful and accurate, skin testing is the most widely used technique. Skin-prick testing should be the initial test method followed by intradermal testing for patients with clinically suspected allergy but who have negative skin-prick testing. This combined technique has been shown to be superior to radioallergoabsorbent tests (RAST) for establishing a diagnosis of dog allergy [30]. RAST testing should be reserved for those subjects with skin conditions that may interfere with the interpretation of skin tests.

Despite a possible difference in an individual's skin-test sensitivity to specific breeds [24], the clinical relevance of this skin-test sensitivity is unclear. For example, Lindgren *et al.* report no correlation between a patient's report of symptoms related to a particular breed and positive skin tests to antigens derived from that breed [31]. Furthermore, extracts made from mixed breeds of dogs contain a larger number of relevant antigens compared with single breed preparations and therefore appear to be more comprehensive when used to establish a diagnosis [31].

Appropriate therapy for dog allergic patients requires a multi-step approach. The first step should be an attempt to eliminate exposure. If possible, complete avoidance of dogs should be attempted. This will likely decrease but not completely eliminate antigen exposure. A careful assessment of the psychological and emotional impact which may result should be obtained before insisting upon removal of the animal from the home. In addition, several studies have shown a significant health benefit in people who own dogs [32–34]. Measures to limit exposure may be a more acceptable initial approach. Such measures would include attempting to keep the dog outside if possible. The bedroom should remain off limits entirely. Regular cleaning of the floor and furniture is also important. Suggestions to avoid direct contact with the face and to maintain appropriate hygiene (i.e. washing hands, etc.) may also limit exposure. Cleaning the animal regularly may serve to remove other known allergens such as dust mite, pollens and moulds.

For those individuals unable or unwilling to avoid contact with dogs, pharmacological agents such as antihistamines, inhaled corticosteroids, cromolyn preparations and beta-agonist therapy may be necessary to control symptoms. Patients who fail to respond to avoidance and pharmacological measures may be candidates for immunotherapy.

Data on the effectiveness of immunotherapy for dog allergy are conflicting. These studies are often limited by the number of patients and length of study. The lack of standardized extracts has also been a problem both in

research and clinical practice with the potency of commercial extracts varying by a factor of several hundred to greater than a thousand [6, 35, 36]. Despite these limitations, several studies have shown the clinical benefit and safety of immunotherapy for controlling allergic symptoms related to dog exposure [2, 37–42]. The majority of these investigators attempted to use a standardized and purified extract. Hedlin *et al.* also demonstrated that clinically significant improvement may not be apparent until as long as 3 years after initiating therapy [37, 38, 43]. Furthermore, it appears that clinical improvement can be sustained for several years after immunotherapy is discontinued [44]. Sundin *et al.* also demonstrated that accelerated or 'rush immunotherapy' may also be safe and effective [38]. Although immunotherapy with breed specific extracts may occasionally be useful, mixed breed extracts are the most practical and clinically relevant form to be used for diagnosis and treatment for reasons discussed previously.

Summary and approach to management

Exposure to dogs is extremely common. Although strict avoidance of dogs may limit symptoms and should be attempted in patients with severe allergic symptoms, it may be impossible or impractical for patients to avoid this contact. In addition, many patients are either unable or unwilling to part with a beloved pet. It is important for the allergist to recognize and assess all these factors when approaching the dog allergic patient. If careful history, physical examination and objective testing confirm the diagnosis of dog allergy, the allergist must be prepared to work with and help provide a management strategy for their patients.

Limited contact may be a more acceptable approach. In our opinion, suggestions to limit intimate contact (i.e. facial contact or sleeping with animal) may be a reasonable first step. Complete avoidance of dogs is probably not necessary in most cases and therefore removal of the dog from the home should probably be reserved for cases where significant adverse health effects of dog exposure are obvious and when other measures have failed. Measures to limit dander production should be employed such as careful and routine grooming. The animal should be treated promptly and appropriately at the first sign of illness. Dermatological conditions are particularly important in terms of reducing dander production.

If a patient does not improve significantly after attempts of eliminating or limiting exposure and after appropriate pharmacological treatment, immunotherapy should be considered. An attempt should be made to use a standardized and purified extract from mixed breeds containing all relevant antigens with Can f 1 being the primary antigen. Immunotherapy must be continued for at least 3 years to

achieve maximum benefit. For situations where rapid symptom relief is necessary or desired, an accelerated or 'rush' treatment programme appears to offer a safe and effective alternative to conventional immunotherapy.

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