

Is Sensitization to Furry Animals an Independent Allergic Phenotype in Nonoccupationally Exposed Individuals?

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■ Abstract

Background: Patients sensitized to common pets (cat, dog) frequently display an immunoglobulin (Ig) E-mediated response to allergens from other animals.

Objective: To evaluate whether individuals sensitized to common pets might be at higher risk of developing allergic sensitization to other mammalian allergens.

Methods: The study population comprised 900 consecutive patients (300 individuals sensitized to different allergens including those of cat and dog [group A], 300 sensitized to allergens other than those derived from cat and dog [group B], and 300 nonsensitized individuals [group C, controls]). All patients underwent a physical examination, an interview (clinical history, pet ownership, possible exposure data), and skin prick test (SPT) with a standard panel of allergens including cat, dog, horse, rabbit, rat, mouse, guinea pig, hamster, and cow.

Results: A significant difference in allergic sensitization to mammalian allergens was observed in group A compared with group B (respectively, 244 vs 17). No sensitization was found in group C.

Conclusion: Since sensitization to pet allergens increases the risk of developing allergy to other furry animals, we suggest performing SPTs with several mammalian allergens to identify allergic sensitization and thus prevent future exposure in individuals who are highly sensitized and environmentally exposed to common pets.

Key words: Allergic rhinitis. Bronchial asthma. Cat. Dog. Furry animals. Hypersensitivity. Pet allergy. Sensitization to animals.

■ Resumen

Antecedentes: Los pacientes sensibilizados a los animales domésticos comunes (gato, perro o ambos) suelen presentar una respuesta mediada por inmunoglobulina (Ig) E frente a alérgenos de otros animales.

Objetivo: Evaluar si los pacientes sensibilizados a los animales domésticos comunes (gato, perro o ambos) pueden tener un mayor riesgo de desarrollar una sensibilización alérgica a alérgenos de otros mamíferos.

Métodos: La población del estudio incluyó a 900 participantes consecutivos (300 pacientes sensibilizados a diferentes alérgenos incluidos los de gato y perro [grupo A], 300 pacientes sensibilizados a alérgenos distintos de los de gato y perro [grupo B] y 300 individuos no sensibilizados [grupo C, controles]). Se sometió a todos los participantes a una exploración física, una entrevista (antecedentes clínicos, datos sobre convivencia con un animal doméstico o posible exposición) y una prueba de punción cutánea con un panel estándar de alérgenos incluidos los de gato, perro, caballo, conejo, rata, ratón, cobaya, hámster y vaca.

Resultados: Se observó una diferencia significativa en la sensibilización a alérgenos de mamíferos en el grupo A en comparación con el grupo B (244 frente a 17, respectivamente). No se observó ningún caso de sensibilización en el grupo C.

Conclusión: Puesto que la sensibilización a los alérgenos de gato/perro aumenta el riesgo de desarrollar alergia a otros animales peludos, se recomienda realizar pruebas de punción cutánea con alérgenos de otros mamíferos para identificar la sensibilización alérgica y prevenir así futuras exposiciones en pacientes muy sensibilizados y expuestos a animales domésticos comunes.

Palabras clave: Rinitis alérgica. Asma bronquial. Gato. Perro. Animales peludos. Hipersensibilidad. Alergia a los animales domésticos. Sensibilización a animales.

Introduction

Allergic sensitization to common pets (cats, dogs) depends on geographic and behavioral variables and is directly related to pet ownership. For instance, in Northern Europe, approximately 23%-34% of schoolchildren own a cat and/or a dog [1], with the result that, in some areas, 50%-70% of children with bronchial asthma are sensitized to domestic animals [2].

Sensitization to cat and dog are often associated in the same individual, irrespective of direct exposure. This could be due in part to the existence of common epitopes of the major cat and dog allergens and to potential indirect exposure to these antigens [3,4]. Moreover, patients sensitized to cat/dog frequently also display an immunoglobulin (Ig) E-mediated response (sensitization) to proteins derived from other animals [5]. We used skin prick tests (SPT) to evaluate whether there was a difference in rates of sensitization to other mammalian allergens (horse, rabbit, rat, mouse, guinea pig, hamster and cow) in individuals sensitized to common pets.

Methods

Patients

The study population comprised 900 individuals aged between 8 and 77 years (mean, 33.5 years) living in the Naples area and consecutively evaluated in our Allergy Service from January 1, 2008 to December 31, 2008 for respiratory symptoms of suspected IgE-mediated etiology. The patients were subdivided and evaluated according to the presence of a positive SPT result to cat/dog allergens, as follows: 300 patients sensitized to different allergens, including those of cat/dog (group A); 300 patients sensitized to several allergens but not cat/dog allergens (group B); and 300 nonsensitized individuals comprising the control group (group C) (Table 1).

Allergists completed a purpose-designed case report form at each screening visit. The form contained the following items: age, family history of allergy, characteristics of domestic environment, updated clinical history, type and age of onset of clinical symptoms, seasonality of symptoms, presence of pets at home and possible exposure to other animals, results

Table 1. Demographic Data

	Allergic Patients With a Negative SPT Result to Cat/Dog (n=300)		Allergic Patients With a Positive SPT Result to Cat/Dog (n=300)		Patients With a Negative Skin Prick Test Result (n=300) (Controls)	
Sex	140 male, 160 female		131 male, 169 female		133 male, 167 female	
Mean (SD) age, y	35 (16)		30 (13)		38 (18)	
Age range	Male	Female	Male	Female	Male	Female
0-20	57	34	50	41	47	34
21-41	54	74	67	75	44	64
41-60	19	39	12	45	29	39
>60	10	13	1	9	20	23
Family history of allergy	No=131	Yes=169	No=87	Yes=213	No=161	Yes=139
Pet at home	Yes=70	No=230	Yes=148	No=152	Yes=53	No=247
Cat	14		33		15	
Dog	31		63		29	
Cat+dog	10		21		6	
Cat+dog+rabbit	2		3		–	
Rabbit	5		17		1	
Dog+rabbit	3		4		–	
Other animals	4		6		2	
Symptoms	A=21; R=64; RA=101; RC=76 RCA=36; C=2		A=19; R=45; RA=99; RC=69 RCA=068		A=31; R=74; RA=90; RC=67; RCA=37; C=1	
SPT positivity (number of monosensitizations)	DP/DF=167 (27); P=197 (46); G=139 (8); Ol=74 (5); As=60 (6) Alt=8		DP/DF=223 (25); P=200 (8); G=171(7); Ol=115 (2); As=58 (1); Alt=24		Negative SPT result	
	Total number of monosensitizations=92		Total number of monosensitizations=43			

Abbreviations: A, asthma; Alt, *Alternaria*; As, *Artemisia*; C, conjunctivitis; DF, *Dermatophagoides farinae*; DP, *Dermatophagoides pteronyssinus*; G, grasses; Ol, *Olea*; P, *Parietaria*; R, rhinitis; SPT, skin prick test.

of SPTs, and previous/current pharmacological treatment. Patients who were professionally exposed to animals for whatever reason were excluded from the study.

Since the absence of a pet at home does not exclude direct exposure outside the home [6], and considering the unlikelihood of contacts with other animals, we classified animal exposure into 2 categories: positive contact, ie, the presence of pets at home (cat, dog, rabbit, hamster, guinea pig) or direct contact for whatever reason (eg, hobby, sports), although not occupational exposure; negative contact, ie, no direct exposure to a given animal but possible indirect exposure through clothes or other items of individuals directly exposed to animals, or when the patient denied any (known) direct or indirect exposure to animals.

Allergen Extracts and Skin Prick Tests

Commercial allergen extracts were used for the SPTs (Lofarma Laboratories, Milan, Italy). The panel comprised *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Alternaria alternata*, *Cladosporium herbarum*, common pet hair (cat, dog), other mammalian hair (horse, rabbit, rat, mouse, guinea pig, hamster, and cow), *Parietaria*, grass mix, *Artemisia vulgaris*, *Olea europaea*, *Betula pendula*, *Cupressus sempervirens*, and *Corylus avellana*. With the exception of other animal hair, these allergens are considered the most frequent causative agents of respiratory allergy in our geographical area. Positive controls (10 mg/mL histamine

HCl) and negative controls (saline solution in glycerine-phenol solution) were used to verify a normal cutaneous response.

SPTs were carried out and interpreted according to international guidelines [7]. The result was read after 15 minutes and expressed as the longest and perpendicular diameter of the wheal. A skin reaction of 3 mm or greater was considered positive.

Results

Sensitization to all 7 animal allergens (horse, rabbit, rat, mouse, guinea pig, hamster, and cow) was significantly more frequent in the cat/dog-positive patients (group A, n=244) than in allergic individuals with negative SPT to cat/dog allergens (group B, n=17). No sensitization to mammalian hair was found in the SPT-negative control group (group C) (Figure and Table 2).

Rabbit, cow, horse, and hamster epithelia were the most common mammalian sensitizing agents in groups A and B (Figure).

Sensitization to all animals (common pets and other mammals) occurs either in individuals in contact with animals or in group A patients who do not come into contact with animals (Table 2). However, with the exception of cow, sensitization is slightly more common in patients who are in direct contact with animals.

Table 2. Sensitization to Animal Allergens According to Contact

A			B			
Allergic Patients With a Positive SPT Result to Cat/Dog (n=300)			Allergic Patients With a Negative SPT Results to Cat/Dog (n=300)			
Sensitizations to animal allergens according to animal contact			Sensitizations to other animals according to contact (n=17)			
Animal	Contact Yes (n=148)	Contact No (n=152)	Animal	SPT positivity	Contact Yes	Contact No
Cat	118	107	Guinea pig	0	0	0
Dog	121	106	Rabbit	5	3	2
Guinea pig	14	2	Hamster	3	0	3
Rabbit	45	37	Rat	0	0	0
Hamster	16	8	Horse	3	0	3
Rat	0	6	Cow	3	0	3
Horse	29	19	Mouse	1	0	1
Cow	25	26	Rabbit and rat	2	0	2
Mouse	0	17	Total	17	3	14
Total	368	328				

In patients belonging to group B, with the exception of rabbit (a relatively common pet in Italy) [8,9], all sensitizations to mammals were recorded in patients not exposed to animals (Table 2).

Discussion

The results of our study suggest that individuals sensitized to common pet allergens have a significantly higher risk of developing sensitization to other furry animals.

Allergic sensitization to cat/dog is easily explained by the direct contact reported; however, in some cases, sensitization to other mammalian allergens can be explained by direct exposure (denied by most of the patients) or by indirect or unknown exposure (low ownership of cows, horses, and hamsters). Nothing can be hypothesized for indirect contact with rats and mice (extremely uncommon as pets in Italy). Thus, a possible explanation for the high prevalence of sensitization to mammalian allergens in group A could be the cross-reactivity between these allergens, and there have been reports of cross-reactivity between major/minor allergens of mammalian species including horse [10,11], cow [12], dog [13], cat [14], guinea-pig [15], rabbit [16], rat [17], and mouse [18]. These cross-reacting allergens are usually lipocalins, which are typically small proteins whose major feature is the ability to bind small hydrophobic molecules, such as steroids [19,20].

Serum albumin, a thermolabile protein of approximately 68 kDa, is another important panallergen involved in allergy to milk, meat, and epithelia [21-27]. It has recently been demonstrated that, after an initial contact with serum albumin through cow's milk, individuals could become sensitized to epithelium-derived albumin, even in the absence of direct contact with animals [28]. This mechanism could explain the peculiar finding of atopic patients who develop allergic sensitization to mammalian allergens in the absence of contact with animals. For instance, we found that sensitization to cow was unexpectedly high (51/300 in group A and 3/300 in group B). Cross-reactions and indirect exposure may sensitize an individual to furry animals without previous contact. Consequently, patients are not aware of the risk of respiratory symptoms after occasional exposure to an animal. In this context, we previously found that direct contact with a horse or a rabbit triggered severe respiratory symptoms in horse/rabbit-sensitized patients (who were unaware because they were never exposed) [29,30].

Our findings suggest that individuals sensitized to cat/dog and other animal epithelia (horse, rabbit, rat, mouse, guinea pig, hamster, and cow) could represent an independent allergic phenotype. Consequently, it could be useful to perform SPT to these less common mammalian allergens to identify allergic sensitization and avoid future exposure in highly sensitized

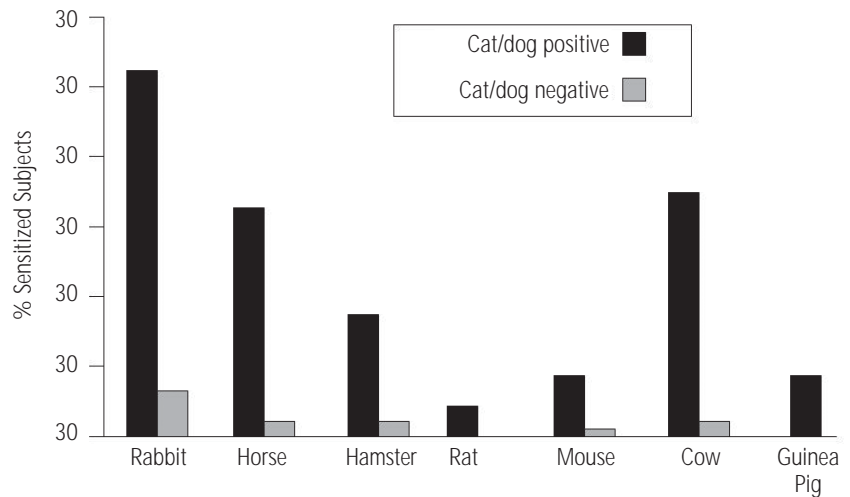


Figure. Sensitization to furry animals in individuals sensitized or not to cat and/or dog allergens.

individuals who are environmentally exposed to common pets (cats/dogs).

In a future study involving the present series, we plan to investigate IgE reactivity to furry animals and determine the panallergens involved in sensitization to several animals.

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