Original Paper

International Archives of Allergy and Immunology

Int Arch Allergy Immunol 2013;162:143–148
DOI: 10.1159/000351416

Received: January 9, 2013
Accepted after revision: April 12, 2013
Published online: July 31, 2013

Prevalence of Atopy and Respiratory Allergic Diseases in the Elderly SAPALDIA Population

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Key Words

Atopy · Allergen-specific IgE · Atopic respiratory diseases · Self-reported allergic rhinitis · Doctor's diagnosed asthma · Elderly · Phadiatop assay

Abstract

Background: Because of changing world demographics, the elderly population is steadily increasing. Few studies have assessed the prevalence of atopy and allergic diseases in elderly persons with objective measures. The aim of this paper is to describe the prevalence of atopy, self-reported allergic rhinitis and doctor's diagnosed asthma in persons over the age of 60 in Switzerland. ***Methods:*** The cross-sectional examination of the Swiss Study on Air Pollution and Health in Adults (SAPALDIA 1), performed in 1991, included 9,651 adults aged 18–60 years. In 2001–2002 the same subjects were invited for a follow-up examination (SAPALDIA 2). Serum samples collected at baseline and follow-up were tested for specific IgE sensitization with the Phadiatop® (Phadia, Uppsala, Sweden, now Thermo Fisher Scientific) assay containing a mixture of common respiratory allergens (grass, birch, mugwort, Parietaria and olive pollen, dog, cat, horse, *Cladosporium herbarum*, house dust mite and flour mite). Atopy was defined as a positive result in the Phadiatop test according to guidelines by the manufacturer. The prevalence rates of atopy, self-reported allergic rhinitis and doctor's diagnosed asthma were evaluated by sex and age group (≤60 or >60 years). ***Results:*** 7,667 subjects (men = 3,692/women = 3,975) participated in the follow-up by responding to a detailed questionnaire (80% of SAPALDIA 1 participants). Phadiatop results were available for 5,835 participants (men = 2,839/women = 2,996). Prevalence rates of atopy (Phadiatop positive) were 36.4% in men aged ≤60 years versus 26.2% in men aged >60 years and 30.6 and 18.1% in women, respectively (both $p < 0.001$). Prevalence rates of self-reported allergic rhinitis in subjects >60 years old were 13.0% for men and 15.4% for women ($p = 0.12$), and for doctor's diagnosed asthma 6.6% versus 7.6%, respectively ($p = 0.40$). Both rhinitis and asthma prevalences were higher in persons <60 years. The results were not sensitive to potential bias from nonparticipation at follow-up as demonstrated by imputation of sex- and age-specific allergic rhinitis and asthma among nonparticipants. ***Conclusions:*** According to our esti-

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mates, the prevalence of allergic rhinitis among persons aged between 60 and 70 years in Switzerland in the present cohort is of the order of 13–15% and should not be underestimated, although it is lower than in age groups ≤60 years.

Introduction

On the basis of a MEDLINE search using the terms 'epidemiology and allergy' it was stated that there was a lack of research on the incidence and prevalence of allergic sensitization in the elderly population [1]. In fact, although in their daily work allergists see more and more elderly patients with rhinitis, asthma and other allergic diseases, few studies have assessed the prevalence of atopy and allergic diseases in elderly patients with objective measures such as skin prick tests to aeroallergens or food allergens or serum IgE determination [2–6]. Because of changing world demographics, it is estimated that the elderly population will increase by 75% between 2010 and 2030 [7].

SAPALDIA (Swiss Study on Air Pollution and Lung Diseases in Adults) was initiated in 1991 in the Swiss population aged 18–60 years, with the primary aims of investigating the prevalence of respiratory and allergic diseases and their associations with air pollution (SAPALDIA 1) [8–11]. The same subjects were invited for a second examination in 2001–2002 (SAPALDIA 2) [12–15]. Serum samples from the formal biobank established at follow-up were analyzed for specific IgE against the eleven most common inhalant allergens in one pool (Phadiatop® assay; Phadia, Uppsala, Sweden, now Thermo Fisher Scientific). The aim of this study was to assess the prevalence rates of atopy (defined as a positive result in the Phadiatop) allergic rhinitis and asthma among participants who were aged between 60 and 72 years in SAPALDIA 2 (see Appendix for details of the SAPALDIA team).

Material and Methods

Study Population

The baseline assessment of the SAPALDIA study was carried out during 1991–1992 in eight Swiss areas with different environmental characteristics (SAPALDIA 1). Participants aged 18–60 years were recruited based on random samples selected from inhabitant registries. The samples were composed to reflect the general Swiss population in urban and rural areas. A baseline participation rate of 80% was achieved. Complete allergy skin and in vitro tests as well as data derived from a health questionnaire were available from 8,357 out of 9,651 baseline participants. The same subjects participating in 1991 were reinvited for a follow-up examination (SAPALDIA 2) between July 2001 and February 2002. With few exceptions, the same examinations were conducted again in SAPALDIA 2. Blood was sampled at both baseline and follow-up examination. The methods in SAPALDIA 1 and 2 have been described in detail elsewhere [8–10, 12, 13].

Assessment of Atopy, Allergic Rhinitis and Asthma

The serum samples were tested with Phadiatop which contains a mixture of common respiratory allergens (grass, birch, mugwort, Parietaria, olive, dog, cat, horse, *Cladosporium herbarum*, house dust mite and flour mite). Positive reaction was defined as proposed by the manufacturer. All serum testing for IgE was done in the Allergy Laboratory of the Department of Dermatology, University Hospital Zurich by the same technicians. Individuals with a positive result in the Phadiatop test were classified as atopic. Based on the questionnaire answers, 'self-reported current allergic rhinitis' was defined by a positive answer to the question, 'Do you have any nasal allergies including hay fever?' 'Asthma' was defined as positive answers to both questions, 'Have you asthma?' and 'Was asthma confirmed by a doctor?'

Statistical Analyses

The raw prevalences of atopy, self-reported allergic rhinitis and asthma were assessed for the age groups ≤60 years and >60 years, for men and women, separately. Differences in prevalence rates between age groups were assessed by Fisher's exact test. In a sensitivity analysis, nonparticipants of SAPALDIA 2 were also included, assuming that their symptom status would not have changed between the two surveys.

Table 1. Crude prevalence rates of atopy (Phadiatop positivity) among SAPALDIA 1 (1991/92) and SAPALDIA 2 (2001/02) participants <60 and >60 years (n = 5,463)

Age class category, years	SAPALDIA 1	SAPALDIA 2
<60	29%	33%
>60	–	22%

Results

A total of 7,667 subjects (men = 3,692/women = 3,975) participated in the SAPALDIA follow-up study (SAPALDIA 2) and responded to a detailed questionnaire (80% of SAPALDIA 1 participants). For 5,835 subjects (men = 2,839/women = 2,996) Phadiatop results were available at follow-up. Atopy results were available for 5,463 participants from both time points. According to table 1 the crude prevalence rates of atopy (Phadiatop positivity) among SAPALDIA 2 (2001/2002) participants (n = 5,463) over the age of 60 was 22%. As SAPALDIA 1

Table 2. Gender-specific prevalence rates of atopic sensitization, self-reported current allergic rhinitis and doctor's diagnosed asthma in SAPALDIA 2 (2001–2003) participants <60 and >60 years

	Men ≤60 years[a], %	Men >60 years[a], %	Women ≤60 years[a], %	Women >60 years[a], %	Sex differences p values
Atopy (Phadiatop positive)					
men = 2,839/women = 2,996	36.4	26.6***	30.6	18.1***	both <0.001
Allergic rhinitis					
men = 3,692/women = 3,975	21.6	13.0***	24.5	15.4***	0.01/0.12
Diagnosed asthma					
men = 3,693/women = 3,974	8.3	6.6	8.4	7.6	0.88/0.40

*** $p < 0.001$ for difference in prevalence rate between age groups (Fisher's exact test).
[a] At follow-up assessment in 2002.

Table 3. Gender-specific self-reported allergic rhinitis and asthma at SAPALDIA 2, including data from SAPALDIA 2 nonparticipants

	Men ≤60 years[a], %	Men >60 years[a], %	Women ≤60 years[a], %	Women >60 years[a], %
Allergic Rhinitis				
men = 4,744/women = 4,906	20.4	13.2	22.7	15.1
Diagnosed asthma				
men = 4,744/women = 4,906	8.2	6.7	8.4	7.4

Symptom status was carried forward from SAPALDIA 1 and age was imputed by adding 11 years to age at SAPALDIA 1.
[a] At follow-up assessment in 2002.

studied the Swiss population aged 18–60 years, the rate over the age of 60 could not have been assessed at the baseline examination of the cohort in 1991. The rate under the age of 60 was 29%; there was also a slight increase in SAPALDIA 2 in this age group to 33%. Among subjects aged 60 years or more in SAPALDIA 2, the incidence rates of new atopy from SAPALDIA 1 to SAPALDIA 2 were 7.2% (39/538) in men and 4.0% (26/656) in women, and the remission rates were 22.5% (46/204) in men and 22.4% (35/156) in women. Table 2 compares the gender-specific prevalence rates at follow-up for atopy, self-reported current allergic rhinitis and doctor's diagnosed asthma in the age groups ≤60 versus >60 years. The atopy prevalence rates were 36.4% in the men aged ≤60 versus 26.2% in the men aged >60 years. Corresponding rates in women were 30.6% and 18.1%, respectively (both $p < 0.001$). The prevalence rates for self-reported allergic rhinitis in subjects >60 years were 13.0% for men and 15.4% for women ($p = 0.12$), and for doctor's diagnosed asthma 6.6% and 7.6%, respectively ($p = 0.40$). For both self-reported diseases, rates were higher among persons <60 years. After imputation of self-reported allergic rhinitis and asthma for SAPALDIA 2 nonparticipants the prevalence rates were not substantially different (table 3).

To address the question of whether the high prevalence observed at age 60+ is the result of a birth cohort effect, we conducted a logistic regression analysis for Phadiatop positivity including birth year, birth year squared and an indicator variable for subjects aged 60 years or more in SAPALDIA 2 as independent variables. There was some indication of a slight slowing of the general trend of decreasing atopy with increasing age of the birth cohort. However, the indicator variable for subjects aged 60+ in SAPALDIA 2 was highly insignificant in this model, showing that these oldest birth cohorts fitted well into the overall pattern.

Discussion

Our findings show a high prevalence of allergic rhinitis in the elderly (13% in men and 15% in women). Prevalence rates of IgE-mediated sensitization and,

therefore, presence of atopy (Phadiatop positive) were even higher, with 26.2% in men and 18.1% in women (both $p < 0.001$). There is no indication that these high prevalence rates might have resulted from a birth cohort effect.

Some allergens that are important in certain regions such as cypress, ragweed or Alternaria might be missed by Phadiatop. However, cypress pollen is not reported in relevant numbers in Switzerland and ragweed pollen plays a role only in some very limited areas such as Geneva or Ticino, as reported [14, 15].

The prevalence of sensitization against Alternaria is quite low in Switzerland with about 1.7% (unpublished own results from a study with skin prick tests on 331 patients); however, some of these patients indeed might be missed with Phadiatop and the sensitization rate might therefore be even slightly higher.

The results of our study are in line with the few results published to date about the relatively high prevalence of atopy and allergic diseases in the elderly population. In the 1990s, Kerkhof et al. [15] reported age- and sex-specific data on the prevalence of specific IgE tests to common aeroallergens in a random sample of 2,496 subjects aged 20–70 years from the Dutch general population. In the 60- to 70-year-old age group, the prevalence of at least 1 positive specific IgE test was 19% in men and 21% in women. In a study of an unselected Swiss population performed in 1986, it was shown that more than 4% still had hay fever and other atopic diseases after their 60th birthday [16]. PAQUID (Personnes Agées QUID), a cohort of randomly selected subjects over the age of 65 living at home in the South-West of France [5], included 158 men (45%; mean age 74 ± 5 years) and 194 women (55%; mean age 75 ± 7 years). The atopic status was also assessed in vitro by Phadiatop determination. There were 42 (11.9%) subjects with a positive Phadiatop test, and the test was uncertain in 2.3% of subjects ($n = 8$). The proportion with atopy was similar in men (13.9%) and women (10.3%).

In Portugal, the prevalence of allergic rhinitis was evaluated in a cross-sectional, population-based study of 6,859 subjects aged 16–95 years by questionnaire. Different rhinitis subtypes were assessed by applying the clinical criteria of the new ARIA classification (intermittent and persistent rhinitis), including differences or similarities in demography among others [17]. The estimated prevalence of rhinitis was 26.1% (48% for intermittent vs. 52% for persistent rhinitis). This study also included individuals older than 65 years. The prevalence of rhinitis found in this elderly group (25.9%) did not differ from the prevalence found in younger participants. In fact elderly persons presented rhinitis prevalence (for persistent and intermittent types) similar to nonelderly adult study subjects.

A recent longitudinal study with 20 years of follow-up (1989–2008) performed in Legnano, Northern Italy, focused on Ambrosia allergy. In 1999, 13.7% of the patients exhibiting a sensitization to Ambrosia pollen were older than 50 [18]. In 2006, this percentage increased to 30.4%. In contrast, the percentage of grass pollen-sensitized patients older than 50 remained stable over time (9.3% in 1999 and 9.5% in 2006). The percentage of the Ambrosia-sensitized patients older than 60 years was smaller but, nevertheless, there was an increase from 5.8% in 1999 to 9.5% in 2006. Grass pollen-sensitized persons over the age of 60 made up 3.5% and 4.1% in 1999 and 2006, respectively. Exposure of the general population in an area to new airborne allergens resulted in the onset of respiratory allergy in many older people who lacked any relevant predisposing factor, as was shown also for the area north of Milan during a period of 15 years [19].

A novel aspect of our study is the observed small difference between atopic and allergic women (18 vs. 15.4%) over the age of 60, as generally many atopic subjects do not develop clinical allergy. When looking at the sensitivity and specificity of a positive Phadiatop test result as predictor of allergic rhinitis in the SAPADLIA 2 sample, it turned out that the group of women aged 60+ was different from the other three groups. Sensitivity in this group was only 57% compared to values of over 70% in the other three groups, while specificity was higher with 91% compared to 82% in the other three groups. We are planning for atopy analyses in blood collected at the third follow-up of the SAPALDIA cohort. As detailed information on hormonal and reproductive factors was obtained during that follow-up, we will be able to investigate potential reasons underlying the observed differences in test sensitivity and specificity. At this point in time we can only speculate that this age and gender group may be more sensitive to clinical allergy or may differ with regard to symptom reporting.

In conclusion, the few available descriptive studies demonstrate that the prevalence of atopic sensitizations and atopic diseases ranges between 12 and 25% after the age of 60 years. Atopy thus remains a clinically relevant problem in this age group. Also, elderly people can develop allergic sensitization and allergic diseases, even if their proportion is lower than for younger people.

Appendix

The SAPALDIA Team

Study Directorate

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The study could not have been done without the help of the study participants, technical and administrative support and the medical teams and field workers at the local study sites. Local fieldworkers : Aarau: S. Brun, G. Giger, M. Sperisen, M. Stahel. Basel: C. Bürli, C. Dahler, N. Oertli, I. Harreh, F. Karrer, G. Novicic, N. Wyttenbacher. Davos: A. Saner, P. Senn, R. Winzeler, Geneva: F. Bonfils, B. Blicharz, C. Landolt, J. Rochat. Lugano: S. Boccia, E. Gehrig, M.T. Mandia, G. Solari, B. Viscardi. Montana: A.P. Bieri, C. Darioly, M. Maire. Payerne: F. Ding, P. Danieli, A. Vonnez. Wald: D. Bodmer, E. Hochstrasser, R. Kunz, C. Meier, J. Rakic, U. Schafroth, A. Walder.

Funding Statement

The Swiss Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA) was supported by the Swiss National Science Foundation (grants no 33CS30_134276/1, 33CSCO-108796, 3247BO-104283, 3247BO-104288, 3247BO-104284, 3247–065896, 3100–059302, 3200–052720, 3200–042532, 4026–028099, 3233–054996, PDFMP3–123171), the Federal Office for Forest, Environment and Landscape, the Federal Office of Public Health, the Federal Office of Roads and Transport, the canton's government of Aargau, Basel-Stadt, Basel-Land, Geneva, Luzern, Ticino, Valais, Zurich, the Swiss Lung League, the canton's Lung League of Basel-Stadt/Basel-Landschaft, Geneva, Ticino, Valais and Zurich, Schweizerische Unfallversicherungsanstalt (SUVA), Freiwillige Akademische Gesellschaft, UBS Wealth Foundation, Talecris Biotherapeutics GmbH and Abbott Diagnostics.

Acknowledgement

We would like to thank the field workers who collected the data and biological samples in the two SAPALDIA studies for the present analysis and in particular Ms Irène Cuhat Stark and Ms Suzanne Marti-Wyss of the Allergology Laboratory, Department of Dermatology, Zurich University Hospital and Ms Marie-Claire Weber-Lurati of the Immunology Clinic, Zurich University Hospital for their reliable work for the determinations of the specific IgE (Phadiatop) in both instances.

Disclosure Statement

None.

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