

Hypoxemia: an early indication of pigeon breeders' disease.

Clinical and laboratory findings among pigeon breeders in the Salonica area

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Summary. The purpose of this study is to identify pathological findings among pigeon breeders in the Salonica area. Fifty-four volunteer breeders with varying intensity of contact with pigeons participated in the study. All the breeders, after filling in a questionnaire that included questions about the existence of conjunctivitis, rhinitis, chronic cough and sputum, were subjected to clinical examination and spirometric, hematological (arterial and venous), radiographic and immunologic tests. Twenty-five point nine percent of the breeders suffered from conjunctivitis, 31.5% from rhinitis and 33.3% from chronic cough and sputum. Fourteen point eight percent of them had class I precipitins, 7.4% had class II, 5.6% had class III and 16.7% had class IV and a positive correlation of precipitin class with the number of pigeons bred was found. Seven breeders (13%) had hypoxemia at rest and other 8 (14.8%) presented with hypoxemia after the exercise testing. Two breeders presented with a combination of findings of allergic alveolitis that satisfied the criteria of the Pigeon Breeders' Disease (PBD). A substantial number of the examined pigeon breeders were sensitized to pigeon serum antigens. Arterial hypoxemia, either at rest and/or after exercise was observed in 27.8% of breeders. Three point seven percent of breeders presented with clinical and laboratory findings consistent with PBD. Chronic cough and sputum in pigeon breeders should be considered as a possible manifestation of PBD.

Key words: Pigeon breeders' disease, hypoxemia, chronic cough, allergic alveolitis, precipitins.

Introduction

Pigeon breeder's disease (PBD), a frequent form of allergic alveolitis, is difficult to diagnose in the everyday clinical practice. Present and past medical history, which constitutes the dominant and vital part of diagnosis, is not taken into consideration most of the times. The symptoms of the disease are not specific, its progression is usually gradual and as a result it is often misdiagnosed either as influenza or pneumonia.

The diagnosis is associated from the beginning with the tracing in patients' serum of specific IgG antibodies

against pigeon serum antigens [1]. Nevertheless it is still not clear how the exposure to pigeon antigens and the presence of specific IgG antibodies can be associated with the development and manifestations of the disease [2]. The current concepts of the immunopathogenesis of the pigeon breeder's disease, a typical form of allergic alveolitis, have been recently reviewed [3].

The aim of this study is to research the onset of the characteristics of PBD among pigeon breeders in the Salonic area and the symptoms they develop due to their exposure to pigeons, in association with the tracing of specific IgG precipitins in their serum.

Materials and methods

1. Subjects

In order to perform this study, pigeon breeders were sought in specific shops in Salonica known as "taouksidika", were breeders socialize. The selection criteria of the subjects that were accepted and examined were the systematic pigeon breeding and their voluntary participation. One hundred and eighty-three subjects were invited of whom 67 accepted to participate. Thirteen subjects were excluded from the study because they were suffering from other diseases: 2 from COPD, 3 from asthma, 1 from coronary disease, 1 from mental disease and 6 because they had positive prick tests to pollen, fungi or acari. Fifty-four subjects, all men, were included in the study.

The 54 participants (breeders) were all men aged between 24 and 45 years old with a mean age of 38 ± 3.3 . Thirty-three of them were smokers, 14 non-smokers and 7 had a past history of smoking (ex-smokers). All the subjects filled in a questionnaire with the following: a) personal data (sex, age, profession and smoking habits) and b) number of pigeons they were breeding.

The subjects were separated in three categories according to the number of pigeons they had: 1) 1-50 pigeons (19 subjects), 2) 51-100 pigeons (12 subjects) and 3) >100 pigeons (23 subjects).

2. Methods

The questionnaire asked the subjects if they had or used to have symptoms of conjunctivitis or rhinitis right after their dealing with pigeons, when they were entering or exiting or cleaning the loft. They were also asked if they had or used to have symptoms resembling those of chronic bronchitis, such as chronic cough with spitting [4].

All the participants were subjected to clinical examination, which included lung auscultation to rule out wheezing, crackles or rales, heart auscultation and inspection for clubbed nails [5]. An electrocardiogram of all the participants was taken.

Then all subjects underwent spirometry, and vital capacity (VC), forced expiratory flow in 1-second (FEV_1) and maximal midexpiratory flow (FEF_{25-75}) were measured. Next, spirometry was repeated after bronchodilation.

The following hematological tests were performed: Complete Blood Count (CBC), rheumatoid factor, antinuclear antibodies, immunoglobulins A, M, G, E and specific IgG precipitins against the pigeon serum antigens with the ELISA method according to Andersen et al [6]. A chest x-ray of all the participants was taken.

A test of blood gases with puncture of the radial

artery followed. The partial pressure of oxygen (PaO_2), the partial pressure of carbon dioxide ($PaCO_2$) and the pH of blood were measured, and the alveolar-arterial oxygen pressure difference ($P_{(A-a)O_2}$) was calculated.

Then the subjects took a submaximal exercise testing as follows: each subject had to reach 80% of the predicted maximal heart rate on a cycle ergometer. At the completion of the above physical test the measurement of the blood gases and the alveolar-arterial oxygen pressure difference was repeated using the same procedure [7].

3. Statistical analysis

The data were described using the mean and standard deviation of the sample. The parametric Student's t-test for independent samples was applied in order to verify the biostatistical hypothesis tests. The chi-square test for linear trends and the Pearson's R for non-parametric measurements were also applied [8].

Results

The main clinical manifestations of the breeders, based on the questionnaire that was used were the following: fourteen (25.9%) presented with symptoms of conjunctivitis, 17 (31.5%) presented with symptoms of rhinitis right after entering the pigeons' loft and 18 (33.3%) suffered from chronic cough and sputum.

All the participants had normal x-rays, as well as CBC, rheumatoid factor, antinuclear antibodies and immunoglobulin values. The mean values of FEV_1 , VC and $FEF_{25-75\%}$ were $93.4 \pm 14.3\%$ predicted, $95.3 \pm 14.1\%$ predicted and $89 \pm 20.8\%$ predicted respectively. In 8 breeders (14.8%) low FEV_1 (< 80% of the predicted) was found while in 10 of them (18.5%) low $FEF_{25-75\%}$ (<60% of the predicted) was observed.

In 24 participants specific IgG precipitins against the pigeon serum antigens were traced, as shown in Table 1.

The correlation between the number of pigeons each participant dealt with and the class of precipitins that

Table 1. Tracing of specific precipitins.

Precipitins	IU/ml	Breeders
Class 0	< 0.35	30 (55.6%)
Class I	0.35-0.70	8 (14.8%)
Class II	0.71-3.50	4 (7.4%)
Class III	3.51-7.50	3 (5.6%)
Class IV	>7.50	9 (16.7%)

was measured in their serum according to Pearson's-R method was statistically significant ($p < 0.05$). The above is shown in Table 2.

Table 2. Correlation of the number of pigeons bred with the class of specific precipitins.

Number of Pigeons	Number of breeders	Breeders/ Class of precipitins
1-50	19	13/class 0 4/class I 2/class II
51-100	12	7/class 0 3/class I 2/class IV
>100	23	10/class 0 1/class I 2/class II 3/class III 7/class IV

Table 3 shows the correlation between the smoking habit and the existence of chronic cough with sputum in pigeon breeders. Six of the 21 non- and ex-smokers had chronic cough and sputum, while 17 of the 33 smokers reported the above symptoms.

Table 3. Correlation of smoking habits with chronic cough and sputum in breeders.

	Breeders	Breeders with chronic cough and sputum
Non-smokers	14	3(21.4%)
Ex smokers	7	3 (42.8%)
Smokers	33	17 (51.5%)

The blood gases of the participants were measured at rest as well as after the exercise testing. The mean values of $P\alpha O_2$ were 90.7 ± 9.4 mm Hg at rest and 86.9 ± 12.4 mm Hg after exercise testing. At rest 47 subjects had normal $P\alpha O_2$ (95.6 ± 5.1 mm Hg) while 7 had hypoxemia (73.3 ± 4.6 mm Hg). After exercise testing 39 subjects remained normal (97.9 ± 5.7 mm Hg) while

15 presented with hypoxemia (66.1 ± 8.5 mm Hg). A statistically significant difference was found between the mean $P\alpha O_2$ value at rest and the respective one calculated after the exercise testing ($p < 0.05$). All the hypoxemic subjects, either at rest or after the exercise testing, presented with an increased value of the alveolar-arterial oxygen pressure difference ($P_{(A-a)} O_2$). Seven hypoxemic subjects at rest had a $P_{(A-a)} O_2$ value of 30.7 ± 6.7 mm Hg while fifteen hypoxemic subjects after exercise had a $P_{(A-a)} O_2$ value of 36 ± 8.7 mm Hg.

Finally, two subjects presented with crackles and rales in the lower lobes of their lungs during the clinical examination, a reduction of VC in the spirometry ($< 80\%$ of the predicted), class IV precipitins in their serum and hypoxemia at rest, which was becoming worse after the exercise testing. The above were diagnosed allergic alveolitis.

Discussion

Pigeon breeding is a popular hobby mainly among people of the lower socioeconomic class in Greece. Although many studies can be found in the literature on the health damages pigeon breeders suffer from, no work has been published based on the Greek pigeon breeders [9,10]. This implies that the problems of breeders are either neglected or not diagnosed early and as a result damages may occur that are often not attributed to pigeon breeding. Timely diagnosis of PBD is of particular practical importance, since by keeping early-stage sufferers away from pigeons the course of the disease can usually be reversed [11].

Diagnosis of PBD can usually be based on a combination of clinical and x-ray findings, abnormal spirometry and the tracing in the patients' serum of the specific IgG precipitins, following of course, indications found in the patients' medical history. There is no test however, that guarantees the precise diagnosis of the disease [12]. Recently, the presence of rheumatoid factor was found useful in discrimination of pigeon breeders' disease from other interstitial lung diseases [13], but this factor was not present in any of our patients.

The tracing of the specific IgG precipitins in the breeders' serum primarily reflects the intensity of the breeders contact with pigeons, rather than constituting a proof of the existence of the disease [14]. It is a fact that there is considerable diversity of symptoms reported by pigeon breeders and the symptom profiles often do not fit easily into recognizable disease categories. This is likely to reflect the wide range of dust and antigens in the pigeon loft [15]. In the present study, positive precipitins have been identified in the serum of 44.4% of breeders and the correlation between the number of pigeons each participant dealt with and the class of precipitins that was measured in his serum was statistically significant.

In the present study, it was found that exposure to

pigeons causes several breathing-related symptoms to the breeders. The most frequent symptom in the examined group was rhinitis, a finding consistent with the results of other studies [16] and chronic cough and sputum. Rhinitis symptoms were immediate after the breeder's entry to the loft. Rhinitis however, deterred no breeder from dealing with pigeons.

Three of the participants in the study who presented with chronic cough and sputum were non-smokers and another three were smokers who quit at a young age. All the subjects who suffered from chronic cough and sputum had a breathing disorder of the obstructive type. Especially the non-smokers of the above category of subjects had no obvious reason for developing chronic cough and sputum other than the breeding of pigeons. These subjects had a high level of precipitins in their serum. Consequently, it may be assumed that chronic cough and sputum could be one of the clinical signs of pigeon breeders' disease [17,18].

Examination of the blood gases showed a statistically important drop of the mean value of $P_{a}O_2$ after the exercise testing. The value of $P_{(A-a)}O_2$ was increased in participants with hypoxemia and this increase intensified after the exercise testing. Consequently, since the hypoxemia of the subjects is characterized by increased $P_{(A-a)}O_2$ and is intensified after the exercise testing, it can be hypothesized that diffusing capacity reduction is the cause [19].

Examination of arterial blood gases, especially after the exercise testing, seems to be an early indication of disorders in the respiratory function of breeders. Breeders with hypoxemia should be advised to eliminate contact with pigeons and also undergo annual tests of their respiratory function. In case they persistently refuse to quit their hobby they should be advised to use a special mask and undergo annual clinical, radiographic and spirometric tests as well as a test of blood gases [20,21].

It is still to be determined whether those subjects presenting with hypoxemia after the exercise testing as their sole pathological symptom, should be subjected to a therapy with corticosteroids or not. Two of the breeders were diagnosed with PBD, a number which is smaller than the numbers found in the literature [22]. The subjects that were found with impaired respiratory function during the present study, refused to stay away from their pigeons and to receive pharmaceutical treatment.

In *conclusion*, a substantial number of the examined pigeon breeders sensitized to pigeon serum antigens and a positive correlation of precipitin class with the number of pigeons bred was found. Arterial hypoxemia, either at rest and/or after exercise was observed in quite a few breeders. Only a small percentage of breeders presented with clinical and laboratory findings consistent with PBD. Finally, the presence of chronic cough and sputum in pigeon breeders should be considered as a possible manifestation of PBD.

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