Clinical Survey of Pigeon Breeders*

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Two-hundred pigeon breeders attending a national convention were studied for a possible correlation between the hobby of raising pigeons and the incidence of respiratory or immunologic abnormalities. Information concerning his exposure to pigeons, respiratory symptoms and smoking habits was obtained from each breeder. Chest x-ray examinations and pulmonary function tests were also obtained, and sera were examined for the presence of precipitating antibody against pigeon antigens. Precipitating antibody was detected in 40 percent of the breeders, and its presence could not be correlated with any of the variables, except with the duration and degree of exposure to birds. No cases of pigeon breeders' disease were detected, and there was no correlation between respiratory symptoms, abnormal pulmonary functions, or chest x-ray films, and degree of exposure to pigeons. These results suggest that the tested group of pigeon breeders probably did not significantly differ from the general population except for the presence of precipitins against pigeon antigens.

Pigeon breeders' disease, a hypersensitivity pneumonitis, occurs in certain sensitized individuals exposed to antigens derived from pigeon materials. The characteristic features of this disorder are recurrent episodes of chills, fever, myalgia, dyspnea and cough, occurring four to six hours after exposure to the offending antigens. However, in some pigeon breeders the disease may present in a more insidious form without acute episodes, but with progressive impairment of pulmonary function. In addition to abnormalities in pulmonary function and chest x-ray films almost all of the patients have serum precipitins against pigeon antigens.

Our previous studies have indicated that approximately 40 percent of breeders without overt respiratory symptoms had serum precipitins against the same antigens, but, in general, of lower titers. The present investigation was undertaken to determine whether there was a correlation between the presence of serum precipitins and measurable changes in pulmonary function and chest x-ray pictures, and also to determine, if possible, the incidence of pigeon breeders' disease in a large number of breeders.

MATERIALS AND METHODS

Subjects
Two-hundred pigeon breeders attending a national convention volunteered for the study. All individuals completed a questionnaire concerning their age, duration of exposure to pigeons, smoking history, occupation, and the presence of symptoms suggesting respiratory disease, such as cough, sputum production or dyspnea. They were also specifically questioned for symptoms characteristic of pigeon breeders' disease and the possible association of these symptoms with exposure to birds.

X-ray and Pulmonary Function Studies
Studies on the volunteers included chest x-ray examinations and pulmonary function tests. Standard 14 x 17 inch...
posterior-anterior chest films were taken with a portable x-ray machine (General Electric X-Ray, Milwaukee, Wisconsin) and developed at the site. All films were interpreted for pulmonary abnormalities at a later date by the same radiologist.

An initial screening test of pulmonary function was performed with a specially constructed pneumotachometer (Medical Science Electronics, St. Louis, Missouri) through use of a waterless spirometer and digital printout of forced vital capacity (FVC), half-second forced expiratory volume (FEV1.0), one-second forced expiratory volume (FEV1.0) and peak expiratory flow rate. The FEV1/FVC ratio was calculated from these results. At least two trials were performed for each subject, and the predicted values from the Veterans Administration cooperative study4 were used for reference. For the purpose of selecting individuals for further testing, an FVC of less than 80 percent of predicted or an FEV1/FVC ratio of 70 percent or below were considered abnormal. These criteria have been shown to provide a fairly high degree of sensitivity with a somewhat diminished specificity, i.e., a larger number of false positives.10 However, since more complete pulmonary function studies were done on the group selected by these criteria, this latter problem was minimized. The individuals who were found to be abnormal on the screening test had complete pulmonary function studies, using a Stead-Wells spirometer (Warren E. Collins, Inc., Braintree, Massachusetts) providing measurements of FVC, FEV1.0, FEV1.0/FVC ratio, forced expiratory flow from 200-1200 ml (FEF200-1200), and forced expiratory flow from 25 percent to 75 percent of the forced vital capacity (FEF25-75). The single-breath carbon monoxide diffusing capacity1 was also determined on these breeders, through use of a gas chromatograph for rapid gas analysis.10

Immunologic Studies

Serum samples obtained from each volunteer were tested by immunodiffusion for the presence of precipitating antibodies to pigeon serum and pigeon dropping extract, using antigens prepared as previously described.8 The precipitin reactions were graded according to the intensity and number of bands as weak, definite or strong.

Exposure Index

Since the number of birds kept and the total duration of exposure as well as the daily exposure varied from breeder to breeder, an "exposure index" was calculated based on the number of pigeons owned, the time spent in the coop each day, and the number of years of exposure to the birds. The range of values for each of the factors was divided into thirds and graded 1 to 3. The total index was derived by adding the grades for the three variables. Thus, the lowest possible exposure index was three and the highest nine.

The historical and laboratory data collected were coded on computer cards and an IBM 360/40 computer was used to facilitate the data analysis.

RESULTS

The characteristics of the population studied are summarized in Table 1. The ages of the breeders, of which 95 percent were males, ranged from 11 to 81 years, with a mean of 50; and the range of exposure to pigeons from six months to 50 years with a mean of 27% years. The average number of birds kept per breeder was 76. The number of cigarette smokers in this group of breeders was 63 or 31 percent. This represents a lower percentage of smokers than the 50 percent reported in the general male population.11 Although 10 percent of the volunteers had symptoms suggestive of atopic disease, these symptoms were not related to contact with pigeons. Eighty-nine, or 45 percent, of the breeders indicated that they experienced respiratory symptoms of cough, sputum production or dyspnea at various times in the past. Only 15 percent of the breeders admitted to having respiratory symptoms of varying severity sometime after entering the pigeon coop. None reported characteristic symptoms of pigeon breeders’ disease.

Table 1—Summary of the Characteristics of the Pigeon Breeder Population Surveyed.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>16-60</td>
</tr>
<tr>
<td>Years of exposure</td>
<td>2-30</td>
</tr>
<tr>
<td>Duration of daily contact</td>
<td>8-48</td>
</tr>
<tr>
<td>Atopic history</td>
<td>Positive in 30 (10%)</td>
</tr>
<tr>
<td>Respiratory symptoms</td>
<td>Present in 89 (45%)</td>
</tr>
<tr>
<td>Abnormal pulmonary function</td>
<td>Detected in 31 (16.5%)</td>
</tr>
<tr>
<td>Serum precipitants to pigeon antigens</td>
<td>Detected in 26 (15%)</td>
</tr>
</tbody>
</table>

*Abnormalities as defined in text.

Evaluation of the chest x-ray films indicated that 26, or 13 percent, of the breeders had some abnormality of the lungs such as hyperinflation, thickening of the diaphragm, granulomatous disease or atelectasis. Eleven of the 26 demonstrated interstitial changes of varying degrees, as observed in some cases of pigeon breeders’ disease.12

Pulmonary function tests were abnormal in 31 (16 percent) of the volunteers. Table 2 summarizes the incidence of the specific abnormalities in this group. Only two subjects demonstrated reduction in all parameters and three had low spirometric values with normal diffusing capacities. The remaining 25 breeders either had a low FVC, FEV1.0/FVC ratio or diminished expiratory flow rates. Eight individuals in this group also had a low diffusing capacity. The latter test was most frequently abnormal in the presence of predominantly obstructive disease. Eleven of the 31 breeders with abnormal function tests were smokers.

Eighty (40 percent) of the volunteers had demonstrable precipitating antibodies against pigeon antigens. The reactions were of varying intensities (Fig 1) and in 17, sera were as intense as seen in documented cases of pigeon breeders’ disease.3,5

The incidence of respiratory symptoms, abnormal chest x-ray films and pulmonary function are shown.
TABLE 2—Types of Abnormalities in the 95 Breeders with Altered Pulmonary Function.

<table>
<thead>
<tr>
<th>No. of Breeders</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>10</th>
<th>4</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>6.5</td>
<td>9.5</td>
<td>13</td>
<td>32</td>
<td>13</td>
<td>26</td>
</tr>
</tbody>
</table>

- FVC**
  * (62-74) | (51-78) | (30-76) | (90-97) | (85-123) | (90-130) | (87-140) |
- FEV1.1
  * (33-38) | (14-69) | (44-69) | (66-79) | (85-101) | (81-110) |
- FEV1/FVC
- FEF25-75%
  * (13-26) | (33-95) | (24-71) | (65-95) | (100-124) | (100-109) |
- FEF25-75%
  * (30-38) | (22-68) | (36-81) | (45-56) | (100-214) | (100-143) |
- DLCO
  * (51-95) | (21-67) | (64-78) | (96-138) | (53-83) | (51-200) |

**FVC = forced vital capacity.
*FEV1.1 = forced expiratory volume in one second.
$FEF25-75% =$ forced expiratory flow rate from 25% to 75% vital capacity.
$FEF25-75% =$ forced expiratory flow rate.

In Table 3. These findings indicate that of the 95 breeders who reported varying degrees of respiratory symptoms, only five had both abnormal chest x-ray films and pulmonary function, while 60 breeders had no abnormalities detectable.

Chi-square analysis, product-moment correlation and the t-test were used to determine whether there were interrelationships between the exposure index, pulmonary function or chest x-ray abnormalities or respiratory symptoms. The analysis revealed that greater exposure to pigeons, as indicated by a higher exposure index, was not associated with either a higher incidence of abnormal pulmonary function, chest x-ray changes, or respiratory symptoms. The exposure index, however, could be significantly correlated with the presence of serum precipitins—either pulmonary function or chest x-ray abnormalities, or with a history of respiratory symptoms.

**DISCUSSION**

The results of this survey indicate that 16 percent of the tested volunteers had abnormal pulmonary function studies and 31 percent had respiratory

![Examples of immunodiffusion patterns of sera from asymptomatic pigeon breeders (central wells) against pigeon serum (PS) and pigeon dropping extract (PDE) (peripheral wells).]
As in our previous studies, 40 percent of the breeders in this survey had serum precipitins against pigeon antigens. However, there was no correlation between the findings of precipitins and the presence of respiratory symptoms and pulmonary function or chest x-ray film abnormalities. The only statistically significant relationship observed was between the presence of precipitins and the index of exposure to pigeons. This suggests that the detection of serum precipitins in breeders indicates, in many instances, contact with birds rather than disease. The association of these antibodies with the diagnosis of pigeon breeders' disease should therefore be considered only after a careful evaluation of the history and clinical findings of the patient.

The proportion of smokers (31 percent) in the breeder population (Table 4) is less than the 50 percent accepted for the general population. Smokers in general population surveys have a higher incidence of pulmonary function abnormalities than do nonsmokers. A similar, albeit a smaller difference was found when comparing the two groups in the present breeder population: 17.4 percent of the smokers and 14.6 percent of the nonsmokers had abnormal pulmonary function. This relatively minor difference may be due to the rather small number of subjects studied, the unavoidable selectivity of the sample, as well as to the fact that the breeders who smoked and had normal pulmonary function had a mean age 12 years younger than that of the breeders who did not smoke but had abnormal function. Evaluation of the exposure indices of the smokers and nonsmokers, with or without pulmonary function abnormalities, revealed no significant differences.

None of the breeders tested presented with the clinical and laboratory features of pigeon breeders' disease. It should be mentioned, however, that the present group of subjects volunteered to participate in the study and thus did not represent a random sample; consequently, the study may contain unknown biases. Individuals with respiratory symptoms may either tend to volunteer to find out more about their symptoms, or possibly they may be reluctant to participate for fear that they may have to give up the breeding of pigeons. It is also possible that the incidence of the disease is too low to have been detected in the present survey.

In conclusion, this study suggests that except for the presence of precipitating antibodies against pigeon antigens, the abnormalities detected were probably not related to the hobby of breeding pigeons since no association could be detected.

### Table 3—Incidence of Respiratory Symptoms, Abnormal Chest X-ray Films, or Pulmonary Function in 200 Pigeon Breeders.

<table>
<thead>
<tr>
<th>Respiratory Symptoms</th>
<th>Chest X-ray Films</th>
<th>Pulmonary Function</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive</td>
<td>Negative</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>Positive</td>
<td>Negative</td>
<td>Positive</td>
<td>60</td>
<td>30.0</td>
</tr>
<tr>
<td>Positive</td>
<td>Negative</td>
<td>Positive</td>
<td>18</td>
<td>9.0</td>
</tr>
<tr>
<td>Negative</td>
<td>Negative</td>
<td>Positive</td>
<td>91</td>
<td>45.5</td>
</tr>
<tr>
<td>Negative</td>
<td>Positive</td>
<td>Positive</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Negative</td>
<td>Negative</td>
<td>Positive</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td>12</td>
<td>6.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Respiratory symptoms: positive = presence of cough, dyspnea, or spu tum production; negative = no symptoms.
**Chest x-rays: positive = evidence of pulmonary disease; negative = no evidence of pulmonary disease.
†Pulmonary function: positive = FVC <80 percent, FEV<sub>1</sub>/FVC <70 percent, or DL<sub>CO</sub> <80 percent of predicted; negative = all functions normal.

### Table 4—Relationship between Smoking, Age, Pulmonary Function and Exposure Index in 200 Pigeon Breeders.

<table>
<thead>
<tr>
<th>Mean Age</th>
<th>Pulmonary Function</th>
<th>Mean Exposure Index</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsmokers</td>
<td>Normal</td>
<td>5.7</td>
<td>117</td>
<td>88.4</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td>6.0</td>
<td>20</td>
<td>14.6</td>
</tr>
<tr>
<td>Smokers</td>
<td>Normal</td>
<td>5.2</td>
<td>52</td>
<td>82.4</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td>5.5</td>
<td>11</td>
<td>17.4</td>
</tr>
</tbody>
</table>

*Abnormal: FVC <80 percent of predicted; FEV<sub>1</sub>/FVC <70 percent of predicted; DL<sub>CO</sub> <80 percent of predicted.

**Exposure index: Calculated on the basis of number of birds kept and hours of exposure. See text.
between abnormalities in pulmonary function, chest x-ray films, exposure index and the presence of respiratory symptoms. The incidence of pigeon breeders' disease cannot be accurately determined from this survey, but probably is low.

ACKNOWLEDGMENT: We thank the officers and members of the American Racing Pigeon Union for their cooperation and efforts in making this study possible. We are also indebted to Miss Marlene Murpooce, Mrs. Barbara Miller, Mr. Donald Kersting and Mr. Fred Hardestin for their able technical assistance.

REFERENCES

The First Impressionist Art Exhibit

The question has sometimes been asked whether Renoir (1841-1919) was really an impressionist. Ultimately he adopted a standpoint very different from that of Monet (1840-1929) and questioned many of the tenets by which impressionism is commonly represented, yet the closest of his association with the movement is beyond question. He contributed with Monet (1840-1929), Pissarro (1830-1903), Sisley (1839-1899), Cézanne (1839-1906), Degas (1834-1917) and others to the famous show at Nadar's gallery. When, as a result, a facetious journalist, noting several pictures entitled "Impression," labelled the group "Impressionists," Renoir obviously shared the nickname with the rest. He continued to show his pictures at exhibitions specifically called, unlike the first, Impressionist. Later he spoke of having in 1874 "founded"—with Pissarro, Monet and Degas in particular—the Salon of the Impressionists.