The Frequency of Allergic Bronchopulmonary Aspergillosis in Patients with Asthma

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ABSTRACT

Background: Allergic bronchopulmonary aspergillosis ABPA is an unusual but not rare illness that affects young atopic adults with allergic asthma. There are clinical and laboratory tests for the diagnosis of ABPA, these tests include history of asthma, peripheral blood eosinophilia, immediate cutaneous reactivity to Aspergillus fumigatus, serum precipitating antibodies to A. fumigatus or elevated total serum IgE and radiological infiltration.

Objectives: This is a case control study designed to evaluate the frequency of allergic bronchopulmonary aspergillosis ABPA in patients with asthma.

Methods: This is a case control study carried on 150 asthmatic patients consulting the allergic disease center of Aljumhori Teaching Hospital in Mosul for the period from November 2003 to July 2004 to identify patients with allergic bronchopulmonary aspergillosis ABPA. Their ages ranged from 6-65 years, 52% of them were females and 48% were males. The results were compared with a 60 apparently healthy individuals selected randomly as a control group.

To prove that patients’ symptoms were allergic bronchopulmonary aspergillosis ABPA, the following tests were performed for all patients, peripheral eosinophilia which was found in 40.6% of asthmatic patients, skin test for Aspergillus which was positive in 51.3%, ELISA test for total IgE which was positive in 28% and chest-X ray abnormalities were found in 17.3% of patients mainly as pulmonary infiltration.

Results: The major criteria for allergic bronchopulmonary aspergillosis ABPA were found in 19(12.6%) patients out of 150. Moreover, it was significantly higher in most age groups mainly in those patients between 6-15 years and 16-25 years of age. Peripheral eosinophilia, Skin test, ELISA and CXR did not appear to be related to the sex of patients or duration of asthma, but they were significantly higher than the control group (P<0.05) in those with atopic asthma associated with other allergic diseases as eczema, urticaria, rhinitis and conjunctivitis.

Conclusion: The current study revealed that 12.6% of asthmatic patients fulfill the criteria of allergic bronchopulmonary aspergillosis ABPA and there was a significant relationship between asthma and Aspergillus fumigatus as a risk factor.

Keywords: Asthma, allergic bronchopulmonary aspergillosis ABPA, peripheral blood eosinophilia, skin test, IgE.
الخلاصة

مقدمة:
تحتبر المشاكلات الدخانية إحدى العوامل الخطرة التي تُسبب مرضي الرئة التي تؤدي بدورها إلى عدة أمراض للشخص المتعرض لها. لذلك، هناك عدد من أعراض سيطرة وفحوصات مخبرية إذا جمعت على شكل مبتكري التعرف أو التشخيص تؤدي إلى تشخيص مرضي الرئة القصبي الرئوي الأرجي وأيضًا عرض استطراحي بروي. كُتبت الكتالوجي المحيطية المكلفة البلازمية ELISA لغرض مستوى الكليبين المُناعي نوع IgE في الدم، تفاعل الجلد القوري لاستخلاص المشاكلات الدخانية، فحص ABPA والخصائص في الدم وتغيرات لا صوبية في نسبة X الصدر.

الأهداف:
تهدف الدراسة الحاصلة إلى تقديم مدى انشار المشاكلات الدخانية في المرضى المصابين بالرب.

المتغيرات المستعملة:
أجريت هذه الدراسة على شكل قطاع يتضمن مجموعة مريضي عدد من المستشفيات رئوي للمرضى في الموصل من شهر تشرين الثاني لعام 2010 وبوابة تموز لعام 2006، حيث بلغ عدد الحالات 150 مريضاً مصاباً بالرب تراوح أعمارهم ما بين 5 و 25 سنة وكان 25% منهم أطفال و48% ذكوراً بينما بلغ عدد الأطفال المصابين في السالين 60 شخصاً.

لا تعتبر تطبيق مبتكري التعرف لغرض تشخيص ABPA أجريت الفحوصات التالية

1. فحص الكتالوجي المحيطية المكلفة بالربوز للدم، وكانت النتيجة موجبة (أي أن هناك ارتفاع في نسبة هذه الكتالوجي) في 0.6% من مرضى الرئة.
2. اختبار الجلد وكانت النتيجة موجبة في 51.3% من مرضى الرئة.
3. فحص ABPA والخصائص في الدم، وكانت النتيجة موجبة في 78% من مرضى الرئة.
4. فحص عدد البلازميات كانت النتيجة موجبة في 86.3% من مرضى الرئة.

النتائج:
وجد ان 12.1% من مرضى الرئة الذين دخلوا في هذه الدراسة كانوا ضمن مبتكري التعرف أو التشخيص للمرضي المصابين بالرب والكتالوجي المحيطية الدخاناء Aspergillus fumigatus، وجد أن 17% من مرضى الرئة الذين دخلوا في هذه الدراسة كانوا ضمن مبتكري التعرف أو التشخيص للمرضي المصابين بالرب والكتالوجي المحيطية الدخاناء Aspergillus fumigatus، وجد أن 50% من مرضى الرئة الذين دخلوا في هذه الدراسة كانوا ضمن مبتكري التعرف أو التشخيص للمرضي المصابين بالرب والكتالوجي المحيطية الدخاناء Aspergillus fumigatus، وجد أن 50% من مرضى الرئة الذين دخلوا في هذه الدراسة كانوا ضمن مبتكري التعرف أو التشخيص للمرضي المصابين بالرب والكتالوجي المحيطية الدخاناء Aspergillus fumigatus.

الاستنتاج:
وجد أن 12.1% من مرضى الرئة الذين دخلوا في هذه الدراسة كانوا ضمن مبتكري التعرف أو التشخيص لمرضي الرئة القصبي الرئوي الأرجي. هذا يعني أنه هناك دلالة إحصائية عالية بين مرضى الرئة والمصابين بالرب والكتالوجي المحيطية الدخاناء Aspergillus fumigatus، حيث تعتبر عامل خطر سبب أو يزيد الخطورة في مرضى الرئة القصبي.

الكلمات المفتاحية:
الرب، داء الرشاشيات القصبي الرئوي الأرجي، الرشاشيات الدخاناء، الكتالوجي المحيطية بالربوز، اختبار الجلد.

INTRODUCTION

Asthma is defined as a chronic inflammatory disorder of the airways, in which many cells and cellular elements play a role. Chronic inflammation is associated with airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing particularly at night and in early morning.

Aspergillosis is defined as infection with one or more species of the genus Aspergillus. Spore like structures called conidia are aerosolized from mold form of organism growing in the environment. When conidia reach tissue, they germinate to form invasive filaments called hyphae. Allergic bronchopulmonary aspergillosis ABPA occurs as a result of hypersensitivity reactions after the colonization of the respiratory tract with Aspergillus most commonly A. fumigatus. The syndrome occurs largely in atopic patients with underlying asthma. It was first described in 1952. There may be areas of lung collapse and bronchiectasis due to...
plugging of a bronchus by casts. A typical cast contains inspissated mucus, often with fungal hyphae; the production of fungal casts is diagnostic. In their absence, however, skin testing with Aspergillus antigen shows immediate type I and type III reaction in 90% of cases and precipitating and RAST antibodies to Aspergillus are detectable in the serum².

Allergic bronchopulmonary aspergillosis ABPA is an unusual but not rare illness that affects young atopic adults with allergic asthma. Aspergillus causes inflammation in the lungs and allergic symptoms such as coughing and wheezing, but does not cause an infection. It is caused by concomitant IgE and IgG antibodies response to the ubiquitous fungus *Aspergillus fumigatus*. The disease may occur in infants and children. It can cause bronchiectasis and other destructive lung changes but tissue damage can be prevented if the conditions are diagnosed and treated properly³,⁵, ⁶.

It is estimated that allergic bronchopulmonary aspergillosis ABPA occurs in 1-10% of patients with asthma, with rare exceptions, it is a disease of persons with atopic asthma, but it also occurs in 10% of children with cystic fibrosis⁷.

It is also becoming clear that many asthmatics with an even severe form of fungal inflammatory lung disease, usually due to *Aspergillus fumigatus* and known ABPA, are often not properly diagnosed and have significant unmet diagnostic and therapeutic needs. The pathophysiology of allergic bronchopulmonary aspergillosis results from florid T-helper cell(TH)2 innate and adaptive immune responses in susceptible hosts who are unable to efficiently clear the respiratory epithelium of inhaled fungal spores⁸. Moreover, the diagnosis of allergic bronchopulmonary aspergillosis ABPA depends on¹,²,³.

**Major Criteria**
1. History of asthma (regardless of severity).
2. Central (proximal) bronchiectasis.
3. Immediate skin reactivity for *A. fumigatus*.
4. Elevated total serum IgE (>1000µg/L).
5. Elevated IgE or IgG for *A. fumigatus*.

**Minor Criteria**
1. Peripheral blood eosinophilia.
2. Precipitating antibodies to *A. fumigatus*.
3. Pulmonary opacities or infiltrates.

The aim of this study is to evaluate the frequency of allergic bronchopulmonary aspergillosis ABPA in patients with asthma.

**PATIENTS AND METHODS**
This is a case control study designed to evaluate the frequency of *Aspergillus fumigatus* among patients with asthma. After taking the consent of patients, one hundred fifty asthmatic patients consulting allergic disease center at Aljumhori Teaching Hospital in Mosul for the period from November 2003 to July 2004 were included in the study. Seventy-two patients (48%) were males and seventy-eight (52%) patients were females.

For the diagnosis of asthma, we depend on the typical history of asthma, clinical examination (presence of rhonchi and wheezes) and estimation of PEFR and PFT(FEV₁, FVC and FEV₁/VC). Pulmonary function tests were performed at the same hospital. Moreover, All tests were free of charge.

**Peripheral Blood Eosinophilia**
Complete blood picture and ESR including total WBC and differential count were done for all patients. The differential white cells count was done in a well-spread film and examined under the oil immersion lens.

**Skin Test**
Skin test was done by intradermal injection of *A. fumigatus* antigens and the result was indicated by observation of the patient for reaction in form of wheal and flare within 20-30 minutes. The following grading was dependent for the skin reaction: 0 No reaction.
1+ Wheat and erythema < 20 mm in diameter.
2+ Wheat and erythema > 20 mm in diameter.
3+ Large wheat and erythema.
4+ Wheat with pseudopods and erythema.

In this test a measured quantity of allergen is injected intradermally using a 27- gauge needle, after 20-30 minutes, the reaction is graded and recorded. The recommended volume ranges from 0.005 - 0.02 ml but it is usually 0.01 ml. Negative and positive controls are used².

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Serological Tests
Enzyme Linked Immunosorbant Assay-ELISA for total IgE. The machine used in this study is EL x 800 Universal Microplate Reader / USA and the kit used was Direct ELISA kit for the quantitative determination of serum total IgE manufactured by Biomaghereb. 24 AV. Ibn Khaldon BT 543 ARIANA 2080/exp. In this study total IgE for A. fumigatus was detected for all asthmatic patients and control group3.

Chest X-Ray
Chest X-ray was done for every patient and the previous chest X-rays were examined when they were available. The chest X-rays abnormalities findings can demonstrate non-homogeneous infiltration with smooth boarders, infiltrates with air fluid levels from dilated bronchi, areas of consolidation, lobar or whole lung collapse, bronchiectasis. The upper or middle lobes commonly mainly affected in patient with ABPA. Any one of the radiological abnormalities mentioned above was considered as a criterion for diagnosis of ABPA4.

Sputum Examination
Sputum examinations including eosinophil count and mycological examination for A. fumigatus hyphae were done. Czapek -Dox agar is used for inoculation of A. fumigatus, the colony of A. fumigatus is downy to powdery in the texture. The surface color varies from blue-green to gray. On microscopical examination, hyphae of A. fumigatus shows frequent septate, colorless to gray hyphae, about 300 micrometer long, branching at 45o with single round - columnar head with very small 2-3 micrometer in diameter5.

Control Group
This group consisted of 60 apparently healthy individuals selected randomly. All the tests done for the asthmatic patients were also done for subjects in this group after taking their consent to participate in this study.

Statistical Analysis
Chi square test was used for statistical analysis between the groups.

RESULTS
One hundred fifty asthmatic patients and sixty apparently healthy control individuals were included in this study. Table 1 shows the age distribution for the asthmatic patients and control group. In control group there were 10 persons in each age group.

Table 1 : Age distribution of patients involved in the study.

| Age Group (Year) | Patients | Control |
|------------------|----------|---------|
| NO. | % | NO. | % |
| 6-15 | 21 | 14.00 | 10 | 16.7 |
| 16-25 | 32 | 21.33 | 10 | 16.7 |
| 26-35 | 30 | 20.00 | 10 | 16.7 |
| 36-45 | 28 | 18.67 | 10 | 16.7 |
| 46-55 | 22 | 14.67 | 10 | 16.7 |
| 56-65 | 17 | 11.33 | 10 | 16.7 |
| Total | 150 | 100 | 60 | 100 |

Overall, major criteria for allergic ABPA was found in 19(12.6%) patients out of 150. Moreover, it was significantly high in most age groups mainly in those patients between 6-15 years and 16-25 years of age Table 2.
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Table 2: Number and percentage of patients fulfill the criteria of ABPA.

| Age group (year) | Number of patients | Patients with ABPA | P-value No. | % |
|------------------|--------------------|---------------------|-------------|---|
| 6-15             | 21                 | 7                   | 33.3        | < 0.01 |
| 16-25            | 32                 | 10                  | 31.2        | < 0.05 |
| 26-35            | 30                 | 1                   | 3.3         | < 0.05 |
| 36-45            | 28                 | 0                   | 0.0         | -   |
| 46-55            | 22                 | 1                   | 4.5         | < 0.05 |
| 56-65            | 17                 | 0                   | 0.0         | -   |
| Total            | 150                | 19                  | 12.3        |     |

Table 3 shows a comparison between asthmatic patients and the control group regarding peripheral eosinophilia, skin test, ELISA for Aspergillus fumigatus and CXR finding. Statistical analysis for all the parameters listed before were significantly higher in asthmatic patients than the control group.

Table 3: Comparison between asthmatic patients and the control group regarding eosinophilia, skin test, ELISA and CXR.

| Test | Patients (n=150) | Control (n=60) | P-value |
|------|------------------|----------------|---------|
| Peripheral eosinophilia | 61 | 40.6 | 11 | 18.3 | < 0.05 |
| Skin Test | 77 | 51.3 | 1 | 1.6 | < 0.001 |
| ELISA | 42 | 28.0 | 2 | 3.3 | < 0.001 |
| CXR | 26 | 17.3 | 0 | 0.0 | < 0.01 |

Table 4 shows the relationship between the sex of patients with peripheral eosinophilia, skin test, ELISA and CXR abnormalities, no statistically significant difference seen between both sexes.

Table 4: The relationship between sex of patients and peripheral eosinophilia, skin test, ELISA and CXR abnormalities.

| Sex of patients | Number of patients | Number of patients with eosinophilia | Number of patients with +ve skin test | Number of patients with +ve ELISA | Number of patients with CXR abnormalities |
|-----------------|--------------------|--------------------------------------|---------------------------------------|----------------------------------|----------------------------------------|
| Male            | No. %              | No. %                                | No. %                                 | No. %                            | No. %                                  |
| Male            | 72 | 48 | 29 | 40.3 | 40 | 55.5 | 20 | 27.7 | 12 | 16.6 | P > 0.05 | P > 0.05 | P > 0.05 | P > 0.05 |
| Female          | 78 | 52 | 32 | 41   | 37 | 47.7 | 22 | 28.2 | 14 | 17.9 | P > 0.05 | P > 0.05 | P > 0.05 | P > 0.05 |
| Total           | 150 | 61 | 77 | 51.3 | 42 | 25   | 26 | 17.3 |     |      |        |        |        |        |
Table 5 shows the relationship between the duration of bronchial asthma and peripheral eosinophilia, skin test, ELISA and CXR findings. There was no significant difference in peripheral eosinophilia, skin test, ELISA and CXR findings in relation to the duration of bronchial asthma.

**Table 5:** The relationship between duration of bronchial asthma and peripheral eosinophilia, skin test, ELISA and CXR abnormalities.

| Duration of asthma (year) | Number of patients | Number of patients with eosinophilia | Number of patients with +ve skin test | Number of patients with +ve ELISA | Number of patients with CXR abnormalities |
|---------------------------|--------------------|------------------------------------|--------------------------------------|----------------------------------|------------------------------------------|
|                           | No.    | %        | No.    | %        | No.    | %        | No.    | %        | No.    | %        |
| 5 ≥                       | 53     | 35.3     | 26     | 49       | 28     | 52.8     | 19     | 35.8     | 12     | 22.6     |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |
| 6-10                      | 47     | 31.36    | 23     | 48.9     | 20     | 42.5     | 14     | 29.7     | 12     | 21.2     |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |
| 11-15                     | 23     | 15.3     | 4      | 17.3     | 14     | 60.8     | 4      | 17.3     | 3      | 13.0     |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |
| 16-20                     | 14     | 9.3      | 4      | 28.5     | 8      | 57.1     | 2      | 14.2     | 1      | 7.1      |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |
| 21-25                     | 11     | 7.3      | 3      | 27.2     | 7      | 63.6     | 3      | 27.2     | 0      |          |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |
| 26 ≤                      | 2      | 1.3      | 1      | 50       | 0      |          | 0      |          | 0      |          |
|                           | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 | P > 0.05| P > 0.05 |

Table 6 shows the relationship between other allergic diseases in asthmatic patients with peripheral eosinophilia, skin test, ELISA and CXR findings. Ninety-four (62.6%) asthmatic patients gave history of other allergic diseases as conjunctivitis, eczema, drug allergy and insect allergy. Peripheral eosinophilia, positive skin test, positive ELISA test for *Aspergillus fumigatus* and CXR abnormalities were found to be significantly higher in asthmatic patients with other allergic diseases than those without other allergic diseases.

**Table 6:** The relation of other allergic diseases in asthmatic patients with peripheral eosinophilia, skin test, ELISA and CXR abnormalities.

| Asthmatic patients | Number of patients | Number of patients with eosinophilia | Number of patients with +ve skin test | Number of patients with +ve ELISA | Number of patients with CXR abnormalities |
|--------------------|--------------------|------------------------------------|--------------------------------------|----------------------------------|------------------------------------------|
|                    | No.    | %        | No.    | %        | No.    | %        | No.    | %        | No.    | %        |
| With other allergic disease | 94     | 62.6     | 47     | 50       | 56     | 56       | 33     | 35       | 21     | 22.3     |
| Without other allergic disease | 56     | 37.3     | 14     | 25       | 21     | 33.5     | 9      | 16.0     | 5      | 8.9      |
| P-Value            | < 0.05 | < 0.05   | < 0.05 | < 0.05   | < 0.05 | < 0.05   | < 0.05 | < 0.05   | < 0.05 | < 0.05   |
Microscopical examination of sputum for Aspergillus fumigatus was positive in 20(13.3%) patients, 51(34%) patients gave history of brownish-plug in the sputum, and 23(15.3%) patients gave history of late-onset skin reaction mediated by IgG and IgM.

DISCUSSION
Severe asthma with fungal sensitization and allergic bronchopulmonary aspergillosis encompasses two closely related subgroups of patients with severe allergic asthma. Pulmonary disease is due to pronounced host inflammatory responses to noninvasive subclinical endobronchial infection with filamentous fungi, usually Aspergillus fumigatus.

The current study indicates that peripheral eosinophilia, skin test, ELISA for Aspergillus fumigatus antigens and radiological abnormalities are statistically significantly higher in asthmatic patients than the control group. Furthermore, allergic bronchopulmonary aspergillosis was more common in this study 12.3% than other studies 1-10% in Harris et. al. 2000, study, and 7-10% in Becker et. al. 1996 study, this appeared to be related to abuse and long duration use of steroid therapy. Other risk factors for invasive aspergillosis may include neutropaenia, solid organ or allogenic stem cell transplantation, leukaemia and other haematological malignancies, cytotoxic chemotherapy, advanced HIV disease, severe chronic obstructive pulmonary disease, critically ill patients on intensive care units and chronic granulomatous disease.

In a meta-analysis of 21 studies, the prevalence of sensitization to antigens in selected patients with asthma was 28%. The prevalence of allergic bronchopulmonary aspergillosis in patients with asthma and those with Aspergillus hypersensitivity were 12.9% and 40% respectively. In addition to increasing risk of allergic bronchopulmonary aspergillosis, sensitization to Aspergillus antigens appears to increase the severity of asthma. The pathogenesis of allergic bronchopulmonary aspergillosis is not completely understood. There does not appear to be a correlation between Aspergillus load in the environment and the development of ABPA.

Allergic bronchopulmonary aspergillosis ABPA was found in 33% of those 6-15 years old and in 31.2% of those 16-25 years old, these results were significantly higher than other age groups. On comparison, Shah et. al. , 2014 reported that ABPA usually seen in the 20-40 years age group and it has been also reported in children and even in infants. Similarly, Gupta, Chandra and Gautam 2012, stated that although ABPA is common in adults between 20-40 years of age many cases have been reported in younger age groups in India.

Peripheral eosinophilia was found in 40.6% of asthmatic patients, a similar result 37% was found by Milgrom and Fick in 1999. Moreover, in this study 18.3% of the control group has eosinophilia, this is because the peripheral eosinophilia has many causes as helminthiasis.

Skin test for Aspergillus fumigatus was positive in 51.3% of asthmatic patients in our study whereas it was positive in 70% and 85% of asthmatic patients according to Tristram and Daniel, 2001 study and Milgrom and Fick,1999 study respectively. The also the early childhood and infants’ patients gave a false reading of skin test due to immaturity of immune system and the older age also gave a false result due to development of desensitization to this antigen and the strength of immune system are decreased. Other causes are immunosuppressive diseases.

ELISA test for Aspergillus fumigatus was positive in 28% of asthmatic patients in this study, while it was positive in 45% and 50% in Milgrom and Fick, 1999 study and Words and Lee, 1999 study, respectively. Moreover, when a patient with asthma appears to have ABPA, but serologic tests are not consistent, one issue is whether that laboratory results are spurious because of poorly reactive fungi used in precipitating Ab. test and enzyme assay to detect anti- Aspergillus fumigatus IgE or IgG antibodies. Another possibility is the presence of another aetiological species of Aspergillus, such as Aspergillus terreus, Aspergillus glaucus or Aspergillus niger.

Radiological abnormalities were found in 17.3% of asthmatic patients, while it was positive in 7-10% of patients as in Mehard et. al., 2001 study of patients in other studies. This may depend on the time of radiological examination since pulmonary infiltrates, which are the most common radiological abnormalities of ABPA, are transient and CXR should be done at appropriate time to detect these abnormalities. Kousha et. al. 2011 stated that chest radiograph may be normal in early stages of the disease. During acute exacerbations, fleeting pulmonary infiltrates are a characteristic feature of...
the disease that tend to appear in the upper lobe and are central in location. The "ring sign" and "tram lines" are radiological signs that represent the thickened and inflamed bronchi and may be seen in chest radiography. At later stages, central bronchiectasis and pulmonary fibrosis may develop.

It was found in this study that the percentage of CXR abnormalities is more than that of Mehard et. al. 2001, this is probably because the CXR in most of patients of ABPA are to bear little or no relationship to severity or chronicity of the disease.

Peripheral eosinophilia, skin test for Aspergillus fumigatus, ELISA for Aspergillus fumigatus and CXR abnormalities were not related to duration of asthma or sex of the patients, but they were significantly higher in patients with bronchial asthma with other allergic diseases than those without other allergic diseases. This is in concordance to the results of Paul, 1999. This is probably because in asthmatic patients with history of other allergic diseases had inherited tendency or familial tendency for hyper production of IgE antibodies to common environmental allergens and the Aspergillus fumigatus is one of them. So, these patients regarded as atopic patients.

CONCLUSION

Allergic bronchopulmonary aspergillosis was found in 12.6% of asthmatic patients and it was more common in younger than older patients. There was no significant relation between duration of asthma and sex of patients with allergic bronchopulmonary aspergillosis.

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