INTRODUCTION

According to WHO data, asthma is an important healthcare problem worldwide. Although the prevalence of asthma in older people is similar to younger ones, the disease is under diagnosed and under treated in elderly population. It is estimated that around 300 million people in the world currently have asthma. In the global burden of asthma report of the Global Initiative for Asthma, the prevalence of
asthma in different countries has been considered to range from 1% to 18% of the population.\textsuperscript{1,2}

Despite remarkable progress in the last 20 years in asthma therapy, the asthma mortality is increasing, due to a wide range of factors, including: history of severe disease progression, difficult access to specialized medical care as well as the lack of constant care, suboptimal pharmacotherapy, psychosocial and family reasons. In 2003, in Romania, the prevalence of asthma in the elderly was approximately 7% (compared with 4.5% prevalence estimated in 1999), slightly lower than in the young population. This fact could have been caused either by the resurgence of asthma acquired as a teenager or young adult, or the “de novo” asthmatic disease developed after 60 years\textsuperscript{1} (about 3-4%), as well as by the delay in diagnosis till old age (there are asthmatic patients with symptoms who were attributed to other health causes).\textsuperscript{4} Asthma in the elderly is under diagnosed and under treated and often the clinical forms of disease are more severe, as well as frequently associated with co morbidities, including atopy.

The causes of the increased incidence of asthma are not fully known, but one of them might be the increased practice of smoking and air pollution.\textsuperscript{5,6} It is widely accepted that asthma is a major public health problem, leading to major individual and socio-economic consequences and generating a lower quality of life, namely higher costs for the healthcare system and disability for the individuals, especially in elderly patients. In many cases, there is an underestimation of asthma symptoms, which are attributed to other existing diseases, cardiovascular disorders or tobacco bronchitis, or to an advanced age or lack of training. There is also a reluctance to accept the onset of asthma in those aged 50-65 years. Based on these facts, a different approach of disease management is required compared to asthma in youths.

The aim of our study was to assess and compare the severity of asthma in the elderly compared to the young, the asthma disease control, the influence of atopy, the influence of co-morbidities on asthma control and to develop an algorithm for the differential diagnosis of asthma in the elderly.

**MATERIAL AND METHODS**

The study includes a group of 108 asthmatics who addressed the Pneumology Ambulatory of the Emergency Clinical County Hospital, Timisoara, between January 2009 and November 2009. The asthmatic patients were divided into two equal groups: group 1 = 54 elderly patients (over 60 years) and group 2 = 54 young adults (aged 20-40 years).

The diagnosis and the stage of severity of asthma were based on clinical and functional assessments, according to GINA 2007, following the recommended items: diurnal and nocturnal respiratory symptoms, degree of alteration of sleep and physical activity, general physical examination. All patients received treatment according to GINA guide.\textsuperscript{7}

Functional evaluation consisted in the measurement of forced spirometry parameters (with a Pony spirometer), followed by assessment of the airway obstruction reversibility (bronchodilation test with inhaled beta\textsubscript{2}-agonist, considered positive at an increase of FEV\textsubscript{1} above 12% from the baseline value).\textsuperscript{8}

The atopic status was assessed by means of allergic skin prick tests to the main pneumallergens: house dust mites (Dermatophagoides pteronyssinus and D. farinae), pollens (trees, grasses, ragweed), animal dander, and fungi, using the standard Halcis kit, in collaboration with the Allergy Unit of Victor Babes Hospital Ambulatory Timisoara.

The interdisciplinary diagnosis was carried out in the Emergency Clinical County Hospital Timisoara, in order to identify the other associated pathological conditions, such as cardiovascular pathology, diabetes and nutrition disorders, mental illness, or chronic degenerative osteo-articular diseases.

Descriptive statistical analysis and subsequent regression formula with Mann-Whitney test were used, and the t-test was applied to get statistically comparative data.

**Figure 1.** Algorithm for differential diagnosis of asthma in elderly (adapted from John Jay Shannon)\textsuperscript{9}

The patients’ selection was based on well established criteria:
- Inclusion criteria: chronic cough symptoms after exposure to allergens or respiratory irritants, daytime or nocturnal dyspnea, exertion dyspnea, wheezing history, persistent chest constriction, existence of a previous asthma without a sustained treatment.

- Exclusion criteria: patients over three months of treatment with inhaled corticosteroids or antileukotrienes, severe chronic diseases; for the skin prick testing: no corticoid treatment in the previous 7 days, antihistamines within the last three days, bronchodilators at least 12 hours before the skin prick test.

Differential diagnosis was established through an adapted and supplemented algorithm, according to the clinical and paraclinical data. Patients were evaluated at the initial visit and after 3 months of treatment, by clinical examination, forced spirometry and the responses to asthma control test (ACT). 9,10

RESULTS

The evaluation of both groups showed a higher addressability of women to the specialized medical care (64.8% in the elderly and 59.3% in the younger patients). Of all the patients, 36% had neither a previous diagnosis of asthma, nor have they been prescribed specific medication. A higher number of elderly patients had mental diseases, cardiovascular disorder and degenerative osteo-articular diseases versus the younger asthmatics, but we found an unexpectedly high number of respiratory diseases in the group of asthmatic young adults. (Table 1)

We found differences within the proportions of the levels of asthma, comparable with those from the literature,12 with a higher prevalence of moderate to severe forms in the elderly, and an equal distribution between mild and moderate forms in the young patients. The main difference between the two groups consisted in the existence of moderate-severe forms of asthma only in group 1 and not in group 2. (Figs. 2,3)

Allergic rhinitis (AR) - diagnosed clinically and by allergy skin prick tests - was present in 40.7% of the elderly and 35.2% of the young asthmatics. (Fig.4) The presence of atopy, demonstrated by the skin-prick tests, was detected in 25.9% of the elderly and 51.85% of the young patients, suggesting the presence of extrinsic asthma in a greater number of cases in young adults. On the other hand, older patients may have a decrease in skin reactivity to aeroallergens, and also a lower sensitivity to inhaled allergens. An equal number of patients in both groups used parenteral corticosteroids before diagnosis (around 23%).

Table 1. The characteristics of the patients in both groups.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (over 60 years, n=54)</th>
<th>Group 2 (20-45 years, n=54)</th>
<th>p value (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergic rhinitis</td>
<td>22 (40.74%)</td>
<td>19 (35.18%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Atopy</td>
<td>24 (44.44%)</td>
<td>30 (55.55%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Allergy skin tests</td>
<td>14 (25.9%)</td>
<td>28 (51.85%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Asthma and allergic rhinitis</td>
<td>19 (35.18%)</td>
<td>29 (53.70%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Mental diseases</td>
<td>4 (7.40%)</td>
<td>1 (1.85%)</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Cardiovascular diseases</td>
<td>11 (20.37%)</td>
<td>4 (7.40%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Rheumatic diseases</td>
<td>9 (16.66%)</td>
<td>-</td>
<td>significant</td>
</tr>
<tr>
<td>Other respiratory diseases (tuberculosis, smoking, sinusitis, recurrent respiratory tract infections)</td>
<td>8 (14.81%)</td>
<td>15 (27.77%)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>ACT questionnaire (visit 1) - controlled</td>
<td>0</td>
<td>5 (9.25%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>less controlled = 17 (31.48%)</td>
<td>less controlled = 31 (57.40%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>uncontrolled = 37 (68.52%)</td>
<td>uncontrolled = 18 (33.33%)</td>
<td></td>
</tr>
<tr>
<td>ACT questionnaire (control visit) at 3 months - controlled</td>
<td>21 (38.8%)</td>
<td>35 (64.81%)</td>
<td>p&lt;0.0001 strong significant</td>
</tr>
<tr>
<td></td>
<td>less controlled = 28 (51.85%)</td>
<td>less controlled = 16 (29.62%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>uncontrolled = 5 (9.25%)</td>
<td>uncontrolled = 3 (5.55%)</td>
<td></td>
</tr>
<tr>
<td>Normal spirometry (V1)</td>
<td>1 (1.85%)</td>
<td>16 (29.62%)</td>
<td>p&lt;0.0001</td>
</tr>
<tr>
<td>Worst FEV1, % predicted (V1)</td>
<td>4 (7.40%)</td>
<td>-</td>
<td>significant</td>
</tr>
<tr>
<td>Night symptoms (V1)</td>
<td>29 (53.70%)</td>
<td>20 (37.03%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Only mild symptoms (V1)</td>
<td>5 (9.25%)</td>
<td>15 (27.77%)</td>
<td>p&lt;0.005</td>
</tr>
<tr>
<td>Prior treatment with corticosteroids</td>
<td>12 (22.22%)</td>
<td>12 (22.22%)</td>
<td>equal</td>
</tr>
<tr>
<td>Prior treatment with theophylline</td>
<td>19 (35.18%)</td>
<td>7 (12.96%)</td>
<td>p&lt;0.0001</td>
</tr>
</tbody>
</table>

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A significantly higher number of elderly asthmatic subjects presented non-respiratory co-morbidities, in comparison with the youth group.

No significant differences were identified in ACT scores between men and women in both groups, but there were significant differences between the two groups on ACT scores at the initial visit (t-test, \( p = 0.001, \text{CI 95\%} \)). Thus, the group of elderly asthmatics had significantly lower ACT scores than the scores obtained by the group of young asthmatics (\( U = 715.5, Z = -4.61, p <0.001 \)). (Fig. 5)

We also compared the ACT scores at the 3-month follow-up visit and we identified also significant differences between the two groups: the group of elderly asthmatics had significantly lower ACT scores than the scores obtained by young asthmatics (\( U = 803.5, Z = -4.17, p <0.001 \)), which shows that asthma in the elderly is more difficult to control in time, even if elderly patients are given stage-appropriate medications. (Fig. 6)
DISCUSSIONS

We found that asthma is more severe in elderly patients and that increased severity depends on the duration of the disease. Asthma is not uncommon in the elderly, and the association with allergic rhinitis or other allergic diseases is not rare.

The data show us the progressive decline of the skin reactivity in the general population and the allergic responsiveness decreased with age. Our study shows that the atopy was frequently associated with AB, and underlines the importance of atopic clinical symptoms in the elderly.\textsuperscript{14,15}

We found significant differences between the association of cardiovascular diseases (hypertension, chronic ischemic disease), arthritis and nutritional diseases in the elderly compared with the youngsters. Elderly patients have fewer diagnosed respiratory diseases associated, as compared to younger patients, due to the fact that a high number of young smokers often have respiratory infectious diseases or tuberculosis (these diseases are more common among young people in our country).\textsuperscript{16}

The previous use of theophylline was predominant in group 1, but, as we expected, an equal number of elderly and young patients had used hydrocortisone hemisuccinate as emergency medication. Asthma was predominant in women in both groups, and the results are comparable with the literature data.\textsuperscript{17}

The algorithm for the differential diagnosis of asthma in adults/elderly adapted from John Jay Shannon\textsuperscript{9} is comprehensive, easy to handle by the specialists and gives a better understanding of asthma in the elderly.

The existence of more severe forms of disease in the elderly at the initial visit could be explained by the late diagnosis, failure to contact a specialist, confusion with other cardiovascular diseases, chronic bronchitis or obesity associated with sedentarism.\textsuperscript{18,19}

We detected significant differences between disease control at 3 months of treatment between the two groups; the young achieved a better control (ACT score), comparable with literature.\textsuperscript{10,11,20}

CONCLUSIONS

Our study demonstrated the clinical differences between the elderly and youth asthmatics, a late diagnosis of AB in the elderly, with more severe forms of disease, association with multiple co-morbidities, especially allergic rhinitis, a difficult disease control over time.

Regardless of disease severity, asthma control is lower in the elderly compared with the young. There are no differences between the shorter duration of disease in the elderly compared to the longer duration in the young adults that might influence the control of this disease.

However, the existing differences between the types of asthmatic disease in the elderly compared with the young, as well as the many possible differential diagnostics, or even the association with other diseases...
with similar respiratory symptoms in the elderly, require a different strategy to tackle this disease, using different management plans for the differential diagnosis, diagnosis and treatment in the elderly.

REFERENCES