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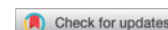
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Asthma control and adherence in newly diagnosed young and elderly adult patients with asthma in Turkey

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ABSTRACT

Objective: This study aimed to evaluate the factors that affect asthma control and adherence to treatment in newly diagnosed elderly asthmatics in Turkey compared with younger patients. **Methods:** This real-life prospective observational cohort study was conducted at 136 centers. A web-based questionnaire was administered to the patients who were followed up for 12 months. **Results:** Analysis included 1037 young adult asthma patients (age <65 years) and 79 elderly asthma patients (age ≥65 years). The percentage of patients with total control in the elderly and young groups were 33.9% and 37.1% at visit 1, 20.0% and 42.1% ($p = 0.012$) at visit 2, and 50.0% and 49.8% at visit 3, respectively. Adherence to treatment was similar for both groups. Visit compliance was better in the elderly group than in the young group at visit 1 (72.2% vs. 60.8%, $p = 0.045$), visit 2 (51.9% vs. 34.9%, $p = 0.002$), and visit 3 (32.9% vs. 19.4%, $p = 0.004$). Adherence to treatment increased with asthma control in both groups (both $p < 0.001$) but decreased with the presence of gastritis/ulcer, gastroesophageal reflux, and coronary artery disease in the elderly. **Conclusions:** Asthma control and adherence to treatment were similar for the elderly and young asthma patients, though the follow-up rate was lower in young patients. The presence of gastritis/ulcer, gastroesophageal reflux, and coronary artery disease had negative impacts on the adherence to treatment in both groups.

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Introduction

The reported prevalence of asthma among adults in Turkey is 2–17% (1,2). The proportion of asthma patients with controlled asthma from cross-sectional studies in Turkey varies from 1.3 to 51.5% (3,4). However, little is known about asthma among the elderly in Turkey. Asthma among the elderly is an issue that has attracted attention in recent years. The high prevalence of comorbidities and their treatment in the elderly and their impact on asthma control has been studied previously (5,6). Ban et al. noted the importance of multifactorial assessments, including comorbidities, treatment adherence, and polypharmacy, for better asthma control in elderly asthmatic patients (7). Turan et al. demonstrated that asthmatic patients have difficulties in using inhaler devices (8). The Global Initiative for Asthma (GINA)

indicated the need for new strategies for elderly asthma patients (9). As discussed by many authors, research on newly diagnosed cases of asthma and real-life asthma studies have a special importance compared with randomized controlled clinical studies (9). Price et al. noted the benefits of real-life asthma studies compared with randomized controlled trials, which have limitations (10). Real-life studies include a wide selection of patients with comorbidities, smoking histories and different lifestyles of care, but randomized controlled studies have inclusion criteria that result in a very narrow group of asthma patients (10).

The present real-life prospective observational cohort study was designed to evaluate the factors that affect asthma control, compliance to visits, and adherence to treatment of newly diagnosed young and elderly

asthmatics in Turkey. We believe that our nationwide findings in real-life conditions, which are the first of their kind to be reported, will improve the therapeutic strategies for and quality of life of young and elderly asthmatic patients.

Some of the results of this study have been previously reported in the form of abstracts (11–13).

Methods

Study design

This study was a national, multicenter, prospective, and non-interventional study focused on the diagnosis and treatment approaches of asthma under real-life conditions aiming to observe the natural progression of asthma in newly diagnosed elderly and younger asthma patients.

The Ethics Committee of Erciyes University Medical School Turkey approved the protocol, dated April 3, 2012 (number: 2012/229). All subjects provided written informed consent. The study was conducted between June 2012 and March 2014.

Patients were enrolled based on the GINA 2012 for asthma. A standard web-based questionnaire, including items related to demographic, clinical, laboratory, and treatment parameters, was administered to the patients. All procedures were administered by the investigators at 136 centers and by the pulmonologists of the secondary and tertiary hospitals. They were supervised by the Executive Board, which consisted of 11 pulmonary diseases specialists, with the help of an authorized contract research organization.

Patients

The physicians consecutively screened all patients to select the study patients and avoid bias. All eligible patients were informed about the study. Asthma patients who met the inclusion criteria below were included in the study:

- Age of diagnosis: ≥ 18 years to ≤ 80 years.
- Diagnosis of asthma within the previous 3 months or after the initiation visit.
- Patients who had not taken asthma maintenance treatment other than short-acting beta-adrenergic agonists.
- Diagnosis of asthma that was validated via respiratory function tests (with reversibility to salbutamol or inhaled steroid therapy at the first or second visit).
- Patients who accepted to sign the informed consent form.

The patients included in this study were evaluated in a previous study that was conducted by us in terms of their clinical and sociodemographic characteristics (14).

Procedures and measures

A “Case Report Form” was prepared by the Executive Board and contract research organization. The study data were assessed and recorded by the physicians at each visit. The data included the information written on the patient’s routine medical records. The previous and current medical history that was collected at the initiation visit included referral information, sociodemographic data (height, body weight, body mass index and education status, and the geographic region where they lived the longest), medical history (reasons for application, concomitant diseases, and family history), risk factors (smoking, occupation, trigger factors, heating and cooking methods), diagnostic tests (including spirometry), and asthma treatment.

After the initial visit, all patients were followed up for 12 months. The frequency of the visits was not determined by the study protocol. Visits between 0 months and 1 month were classified as visit 1 (V_1), those between 1 month and 3 months were classified as V_2 , and those between 3 months and 12 months were classified as V_3 . Therefore, the physicians were completely free to plan the follow-up procedures. The data on the disease progression and outcome that were collected during the follow-up visits included information on the admission (reason for admission, hospitalization, and signs and symptoms), an assessment of the disease control (GINA assessment of asthma control with 4 classical questions and their responses), an assessment of adherence to treatment and a spirometry examination if needed by the physician. Adherence to treatment was evaluated by the physician at each visit using a scale about the medication use pattern: “high adherence” defines patients who use medications regularly, while “medium adherence” and “low adherence” define those who use medications with partial (1–3 days) and severe (more than 3 days) interruptions, respectively; finally, “non-adherence” defines patients who did not use medication.

Data management

The physicians were blinded to the patients of other centers. All lower and upper limits of the laboratory test results, decimals, birthdates, etc. were identified in the software, and entries that were out of the range of the limits were excluded. Each week, the system retrieved and updated the package information (name, dosage, and pharmaceutical form) for all medications from the list on the Turkish Ministry of Health’s website (<http://titck.gov.tr/>) and allowed physicians to choose the correct and valid name of each medication. Inhalers used by the patients were checked by the physician to confirm

patient response. For those who forgot to bring his/her inhaler to visits, the number of inhaler utilized by the patient was questioned using the pharmacy database. For patients with poor adherence, the physician opinion was recorded following the interview with the patient.

To improve the data quality, audit visits were performed at 20 of the centers (15% of the total), which included data from 450 patients (22% of the total patient population), and the data were compared with the source documents. The data were protected at high capacity servers located at the data center of Turk Telekom (the communication and infrastructure provider company). The system equipment was designed in duplicate to provide a back-up in case of any breakdown. The security of the system was ensured by using a firewall, antivirus, antispam, IPS (intrusion prevention system), and VPN (virtual private network). SSL (secure socket layer)/VPN technology was used to encrypt the database. To ensure a secure data transfer, a “https://” (Hyper Text Transfer Protocol Secure) link was used.

Statistical analysis

The patient demographics and disease characteristics are presented using descriptive statistics. Normality of the numeric variables (age, BMI, FVC, FEV₁, FEV₁/FVC) were examined by means of exploring the histograms and also checking the coefficients of variations (mean divided by standard deviation). When the histogram indicated symmetrical distribution with a peak placed near the center of the graph and/or the coefficient of variation was lower than 30%, then the distribution of the variable was assumed to be normal or near-normal. Since all numeric variables showed normal distribution, Student's *t* test was used to compare the means between 2 groups. The chi-square test was used to compare proportions between 2 groups. Fisher's exact test and the Mantel-Haenszel chi-square test were used to compare proportions between 2 groups when the number of cases was low and when the variable to be compared was ordinal, respectively. The data are expressed as the mean $\pm$ SD or as the percentage (%).

To evaluate the association of the selected variables with adherence to treatment, a three-step analysis plan was performed. First, the association of selected variables with adherence was analyzed by means of a chi-square test, Fisher's exact test, or Mantel-Haenszel chi-square test (univariate analyses). Then, logistic regression models were built, which had adherence as the dependent variable and gender, asthma severity, and the variables that were significantly associated with adherence in the first step (presence of comorbidities, obesity, and asthma control level) as the predictors or independent factors (multivariate analyses). Multivariate analyses for all

patients, as well as for the elderly and younger patient subgroups, were performed. All variables were forced to enter the regression model, regardless of their significance. In the final step, the logistic regression models were re-run with a forward stepwise selection method (based on the likelihood ratio) to exclude non-significant variables and build simplified models.

P values less than 0.05 were used to indicate significance.

Results

A total of 1116 newly diagnosed treatment-naïve adult patients with asthma from 136 secondary or tertiary centers were included in the analysis. The patients were categorized into younger asthmatic patients and elderly asthmatic patients according to age (<65 years and $\geq$ 65 years, respectively).

Sociodemographic data

The mean ages were 40.5 ± 11.9 years and 69.4 ± 3.6 years in the younger and elderly groups, respectively. The 2 groups were comparable in terms of gender (65% of the elderly patients and 64% of the younger patients were female). The elderly patients had a higher body mass index than the younger patients (30.0 ± 5.6 kg/m² and 27.9 ± 5.9 kg/m², respectively; $p = 0.002$). The percentage of the younger patients and that of the elderly patients who were smokers were 29.2% and 11.4%, respectively. The younger asthmatics were better educated ($p < 0.001$), were more likely to live in urban areas ($p = 0.010$), and had a higher rate of family history of pulmonary diseases ($p < 0.001$) than the elderly patients. More than half of the elderly asthma patients (64.5%) had a non-allergic phenotype. In the younger group, this figure was 50.2% ($p = 0.030$). In both groups, air pollution was the main trigger factor of asthma (59.7% and 65.9% for the elderly and younger patients, respectively; $p = 0.002$). The elderly group had lower Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV₁), and FEV₁/FVC levels than the younger patients ($p = 0.012$, $p = 0.004$, and $p = 0.005$, respectively) (Table 1).

Comorbidities and medications

The frequencies of patients with comorbidities were 65.8% and 53.0% in the elderly and younger asthmatics, respectively ($p = 0.028$). The most frequently observed comorbidities in the elderly group were hypertension (44.3%), coronary artery disease (15.2%), diabetes mellitus (15.2%), and upper respiratory system disorder (rhinosinusitis and/or polyposis) (12.7%). In the younger group, upper respiratory system disorder, allergic rhinitis, and hypertension were the most frequently reported

Table 1. The demographic characteristics of the study patients with asthma.

	Elderly (n = 79)	Younger (n = 1037)	p value
Female (%)	64.6	64.4	0.98
Age (years) (mean $\pm$ SD)	69.4 $\pm$ 3.6	40.5 $\pm$ 11.9	<0.001
Smoking status (%)			0.009
Current smoker	11.4	29.2	
Ex-smoker	17.7	14.8	
Passive smoker	15.2	12.4	
Non-smoker	55.7	43.6	
Education (%)			<0.001
Illiterate	46.2	10.0	
Elementary school	43.6	42.7	
Secondary school	6.4	12.6	
High school	2.6	20.3	
University	1.3	14.5	
Living area (%)			0.010
Urban	51.9	68.5	
Rural	29.1	18.7	
Mixed	19.0	12.8	
Family history of pulmonary diseases (%)	35.9	59.6	<0.001
Pulmonary function tests			
FVC (% of the predicted value)	75.0 $\pm$ 22.5	81.6 $\pm$ 21.5	0.012
FEV1 (% of the predicted value)	66.9 $\pm$ 16.9	73.9 $\pm$ 20.2	0.004
FEV1/FVC	72.9 $\pm$ 13.5	76.9 $\pm$ 11.7	0.005
BMI (kg/m ²) (%)			0.001
<25	20.8	35.3	
25–29.9	28.6	32.9	
$\geq$ 30	50.6	31.8	

comorbidities. Obesity was more frequently observed in the elderly group than in the younger group. The most frequently prescribed medications for both patient groups were inhaled corticosteroids + long-acting beta 2-adrenergic agonists (94.9% vs. 83.4%, respectively; $p = 0.007$) and leukotriene receptor antagonists (usually as an add-on therapy) (64.6% vs. 51.2%, respectively; $p = 0.022$) (Table 2).

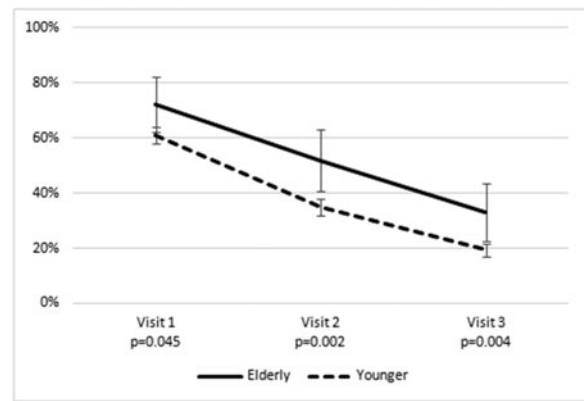
Compliance to visits and asthma control

The elderly group demonstrated a higher compliance to visits than the younger group (number of visits: 1.71 $\pm$

Table 2. The comorbidities and medications of the study patients with asthma.

	Elderly (n = 79)	Younger (n = 1037)	p value
Comorbidities (%)			
Any comorbidity	65.8	53.0	0.028
Hypertension	44.3	11.5	<0.001
Coronary artery disease	15.2	2.6	<0.001
Diabetes mellitus	15.2	5.8	0.001
Upper respiratory tract disorder	12.7	26.1	0.008
Chronic allergic rhinitis	7.6	20.6	0.005
Obesity	50.6	31.8	<0.001
Medications (%)			
ICS + LABA	94.9	83.4	0.007
LTRA (usually as an add-on therapy)	64.6	51.2	0.022
ICS	7.6	12.8	0.175

Note. ICS: inhaled corticosteroid; LABA: long-acting beta-adrenergic agonist; LTRA: leukotriene receptor antagonist.

**Figure 1.** The visit compliance of the patients with asthma. The elderly patients have a better visit compliance throughout the study than do the younger patients. The error bars correspond to the 95% confidence limits.

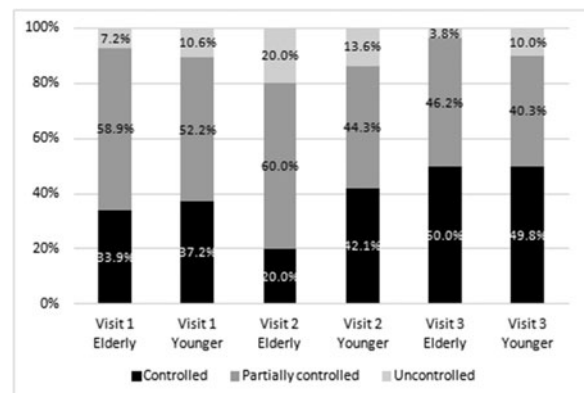
1.46 vs. 1.23 $\pm$ 1.33, respectively; $p = 0.002$). The proportions of patients who attended V₁, V₂, and V₃ were higher in the elderly group (72.2%, 51.9%, and 32.9%) than in the younger group (60.8%, 34.9%, and 19.4%) ($p = 0.045$, $p = 0.002$, and $p = 0.004$ for V₁, V₂, and V₃, respectively) (Figure 1).

33.9% of the elderly patients and 37.1% of the younger patients had a totally controlled disease state at V₁ ($p = 0.83$). The asthma control level improved by V₃ and reached 50% in both groups ($p = 0.59$) (Figure 2).

Adherence to treatment

Adherence to treatment by the end of V₃ revealed no significant difference between the 2 groups, as 82.5% of the elderly group and 76.2% of the younger group used their medications on a regular basis ($p = 0.22$) (Figure 3).

In the elderly patients, the adherence was lower with the presence of gastritis/ulcer, GER, psychiatric diseases, and uncontrolled asthma, as shown in the univariate analyses. Adherence also declined with decreasing levels of

**Figure 2.** The asthma control levels of the patients with asthma.

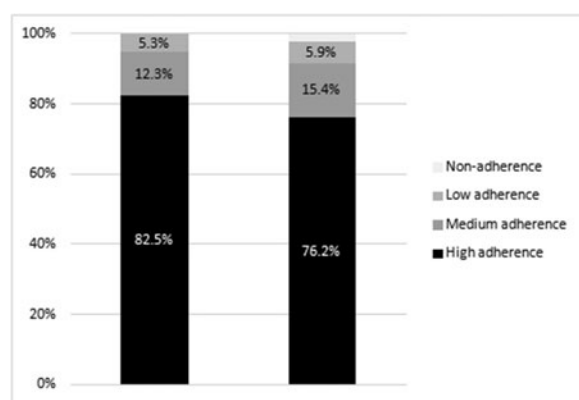


Figure 3. The treatment adherence of the patients with asthma.

asthma control in the younger patients, but no other variables were associated with a low adherence or a high adherence in this group of patients (Table 3).

Multivariate analyses were performed for all patients and for the elderly and younger patient subgroups as well (Table 4). When all patients were considered in the same pool regardless of age and all variables were forced to enter the regression model regardless of their significance, the adherence was better in patients with a comorbidity and in obese patients than in patients without a comorbidity

and in non-obese patients. When the analysis was re-run with a forward stepwise selection method (based on the likelihood ratio) to exclude non-significant variables, the asthma control level remained as the only variable in the model that was significantly associated with adherence.

In the model of the younger patients for which all variables were forced to enter, adherence was better in patients with a comorbidity and was also better in patients with controlled disease. When the analysis was re-run with a forward stepwise selection method, only the asthma control level remained in the model.

Due to small number of elderly patients, a stable multivariate model in which all variables were forced to enter could not be built. Therefore, meaningful figures for most of the variables could not be generated. However, when a forward stepwise selection method was used to select significant variables in the models of the elderly patients, adherence was lower with the presence of gastritis/ulcer, gastroesophageal reflux, and coronary artery disease.

Discussion

The findings of the present study demonstrated that elderly patients have higher frequencies of comorbidities and higher follow-up rates than younger asthma patients.

Table 3. The univariate analysis results demonstrating the association of the variables with adherence to treatment.

		Elderly patients (n = 55–57)			Younger patients (n = 601–622)		
		N	% adherence	p value	N	% adherence	p value
Gender	Male	19	89.5%	0.325 ^a	213	76.1%	0.950 ^a
	Female	38	78.9%		409	76.3%	
Any comorbidity	Absent	21	95.2%	0.053 ^a	268	76.5%	0.827 ^a
	Present	36	75.0%		342	75.7%	
Hypertension	Absent	33	87.9%	0.207 ^a	540	77.0%	0.118 ^a
	Present	24	75.0%		70	68.6%	
Coronary artery disease	Absent	50	84.0%	0.594 ^b	594	76.6%	0.060 ^a
	Present	7	71.4%		16	56.3%	
Gastritis/ulcer	Absent	50	88.0%	0.014 ^b	571	76.5%	0.301 ^a
	Present	7	42.9%		39	69.2%	
Gastroesophageal reflux	Absent	53	86.8%	0.002 ^a	549	76.9%	0.164 ^a
	Present	4	25.0%		61	68.9%	
Diabetes mellitus	Absent	50	82.0%	1.000 ^b	576	76.4%	0.441 ^a
	Present	7	85.7%		34	70.6%	
Psychiatric diseases	Absent	55	85.5%	0.028 ^b	572	76.2%	0.722 ^a
	Present	2	0.0%		38	73.7%	
Obesity	Absent	24	79.2%	0.430 ^a	423	74.2%	0.103 ^a
	Present	31	78.1%		188	80.3%	
Asthma severity	Intermittent	1	100.0%	0.644 ^c	55	87.3%	0.948 ^c
	Mildly persistent	17	82.4%		239	72.8%	
	Moderately persistent	32	78.1%		274	75.2%	
	Severely persistent	7	100.0%		49	85.7%	
Asthma control	Controlled	19	94.7%	0.006 ^c	230	90.4%	<0.001 ^c
	Partially controlled	33	84.8%		319	74.6%	
	Uncontrolled	4	25.0%		64	39.1%	
FEV1 (% predicted)	<80%	44	86.4%	0.362 ^b	372	74.2%	0.274 ^a
	>80%	11	72.7%		233	78.1%	
Number of inhalers	None	19	84.2%	0.991 ^c	244	77.0%	0.720 ^c
	One	36	80.6%		365	75.1%	
	Two	2	100.0%		3	100.0%	

Note. ^aChi-square test; ^bFisher's exact test; ^cMantel–Haenszel test.

Table 4. The multivariate analysis results demonstrating the association of the variables with adherence to treatment.

	All patients				Elderly patients				Younger patients			
	OR	95% CI	p value		OR	95% CI	p value		OR	95% CI	p value	
All variables entered												
Gender	0.887	0.569	1.384	0.598	0.471	0.014	15.724	0.674	0.941	0.600	1.478	0.793
Any comorbidity	1.702	1.041	2.784	0.034	—	—	—	—	1.683	1.023	2.769	0.040
Hypertension	0.542	0.291	1.011	0.054	0.478	0.006	41.407	0.746	0.548	0.276	1.085	0.084
Coronary artery disease	0.378	0.140	1.019	0.055	—	—	—	—	0.345	0.112	1.060	0.063
Gastritis/ulcer	0.660	0.306	1.426	0.291	—	—	—	—	0.853	0.363	2.005	0.715
Gastroesophageal reflux	0.537	0.274	1.055	0.071	—	—	—	—	0.551	0.273	1.113	0.097
Psychiatric diseases	0.981	0.412	2.337	0.965	—	—	—	—	1.243	0.490	3.155	0.647
Obesity	1.730	1.078	2.777	0.023	3.081	0.113	83.955	0.505	1.584	0.969	2.589	0.066
Asthma severity				0.033				—				0.067
Mildly persistent vs. Intermittent	0.532	0.218	1.300	0.166	—	—	—	—	0.536	0.218	1.316	0.174
Moderately persistent vs. Intermittent	0.842	0.343	2.067	0.707	—	—	—	—	0.828	0.336	2.041	0.682
Severely persistent vs. Intermittent	1.648	0.495	5.491	0.416	—	—	—	—	1.475	0.438	4.971	0.531
Asthma control				<0.001				0.688				<0.001
Partially controlled vs. Uncontrolled	17.055	8.466	34.357	<0.001	13.632	0.025	>100	0.415	16.752	8.148	34.444	<0.001
Controlled vs. Uncontrolled	5.135	2.863	9.212	<0.001	6.670	0.073	>100	0.411	4.877	2.668	8.916	<0.001
Constant	0.672			0.458	—	—	—	—	0.643			0.415
Forward stepwise selection												
Asthma control				<0.001				—				<0.001
Partially controlled vs. Uncontrolled	15.473	8.019	29.857	<0.001	—	—	—	—	14.322	7.295	28.117	<0.001
Controlled vs. Uncontrolled	4.901	2.814	8.534	<0.001	—	—	—	—	4.493	2.538	7.953	<0.001
Coronary artery disease	—	—	—	—	0.065	0.005	0.858	0.038	—	—	—	—
Gastritis/ulcer	—	—	—	—	0.038	0.003	0.522	0.014	—	—	—	—
Gastroesophageal reflux	—	—	—	—	0.024	0.001	0.643	0.026	—	—	—	—
Constant	0.610			0.051	38.349			<0.001	0.632			0.078

The 2 patient groups had similar disease control levels and adherence to treatment percentages. The adherence in both groups increased with better asthma control but decreased with comorbid gastroesophageal reflux in the elderly group.

The burden of asthma with regard to mortality, hospitalization, medical costs, and health-related quality of life is more significant in the elderly than in younger populations (7,15). In a recent study by Tsai et al. (16), elderly patients had a fourfold greater overall mortality than asthmatic subjects who were <65 years old.

Smoking

Although the exposure to smoke as a current, previous, or passive smoker was lower in the elderly group than in the younger patients, the exposure was still quite high in the elderly group (44% in the elderly group vs. 56% in the younger group). Similar to what was observed in our study, more than 50% of elderly people with asthma have a history of smoking, either in the past or in the present (17).

Lung function

Our elderly asthmatics had significantly decreased FEV₁, FVC, and FEV₁/FVC values compared with the younger patients. This finding is in line with the current knowledge that older age is associated with a gradual decline in lung function. As previously demonstrated, the FEV₁ value declines with aging (18).

Comorbidities

The percentages of patients with hypertension, coronary artery disease, diabetes mellitus, obesity, and upper respiratory tract disorder were higher in the elderly asthmatic group than they were in the younger patients. Several studies have documented that numerous comorbidities are frequently associated with asthma. Comorbidities that are common within the aging population can negatively affect health outcomes. In a Polish asthma cohort, the mean number of comorbid diseases was markedly higher in elderly patients than in non-elderly ones (19). More than 50% of asthma patients in the elderly population have at least 3 comorbidities, which often go unrecognized and untreated (20). Common comorbidities in elderly asthmatics include gastroesophageal reflux disease, diabetes mellitus, chronic rhinosinusitis with or without nasal polyps, obesity, and congestive heart failure (21). An association between chronic rhinosinusitis and an increased risk for developing late-onset asthma and poor asthma outcomes has been reported (22). Chronic rhinosinusitis is also a significant risk factor for recurrent exacerbation in the elderly (23).

Most of the patients in our elderly asthmatic cohort were either obese or overweight. A European internet-based survey revealed that partially controlled asthmatic patients were older and had a higher prevalence of obesity than were the well-controlled patients (24). In adult patients with asthma, obesity increases the risks of wheezing and corticosteroid insensitivity (26). Obesity is one of the risk factors for the exacerbation of asthma, which

renders the disease more difficult to treat by presumably modulating the patient's immune responses. Therefore, weight loss interventions may improve asthma control-related outcomes in obese patients (26).

Medications

In our study, almost all elderly patients were currently using inhaled corticosteroids + long-acting beta-adrenergic agonists, and two-thirds of the patients were also using leukotriene antagonists (usually as an add-on therapy). Because obesity and other risk factors for attacks are high among the elderly, physicians may consider prescribing these medications. In a recent study by Trink et al. (27), the addition of montelukast to low-dose inhaled corticosteroids in elderly patients with asthma led to fewer exacerbations than monotherapy with inhaled corticosteroids.

Compliance to visits and asthma control

The evaluation of the follow-up visit rate in the elderly group revealed that this rate gradually decreased during the course of the study. Overall, when all 3 visits were considered, the elderly group had a significantly higher follow-up rate compared with the younger group.

The elderly and younger asthmatics in our study were comparable in terms of disease control at both visit 1 and visit 3. The percentages of patients with a totally controlled disease state at visit 2 were 20% in the elderly group and 42% in the younger group. At visit 3, the disease control level improved for both groups. In both the elderly and younger groups, 50% of the patients had a totally controlled disease state at visit 3. The multivariate analysis demonstrated that patients with a well-controlled disease state have a high adherence to treatment, which has been identified by Ban et al. (8).

Adherence to treatment

In our study, the adherence level of the elderly patients was considerably higher than that of the younger patients. Conflicting results have been reported on the treatment adherence of elderly patients. Adherence to treatment is commonly thought to be difficult in older people with asthma. Poor knowledge of the treatment strategy and disease and its consequences may influence the willingness of the patients to use their medications. Polypharmacy, which is frequently present in older populations due to the presence of comorbidities, may also increase the risk of drug interactions. Moreover, ineffective communication between the patient and clinician and concerns about or direct experience with the side effects associated with the drugs may increase the risk of

non-adherence in these patients. Indeed, a low adherence to treatment is common among elderly asthmatics (28). In a retrospective study, only 9–21% of the elderly asthma patients had a high adherence to treatment (29). In an elderly asthma cohort study that was conducted in the United States, 57% had a poor adherence to daily medications (30). In contrast, our findings are supported by another study (31) in which significantly better adherence to treatment was reported in elderly asthmatics than in younger ones. The authors' explanation for this observation was that the elderly asthmatics were retired and had time to take medications regularly. This observation might be valid for the elderly patient population in our study as well.

“The Strategic Implementation Plan of the European Innovation Partnership on Active and Healthy Ageing” (EIP on AHA) (32) and the use of mobile technologies for the treatment of asthma and its comorbidities (33) will help in collecting the data of asthma patients and elderly asthmatics in particular. Turkey is also included in the program and nationwide data collection is on the way.

We believe that our study has some limitations. The study was designed to have a non-interventional approach, which enabled us to collect real-life data. However, the rapidly decreasing number of patients who attended the study visits (along with the real-life patient behavior) prevented us from having enough long-term data. This limiting factor may also have a negative impact on the analysis of other study data. The other limitation of the study is that the patients were not given a questionnaire for the assessment of adherence. Nevertheless, this was overcome simply by examining the prescription records in pharmacy registry when required. Another limitation may be that the study was conducted at secondary and tertiary hospitals and thus did not include primary care patients. This limitation could not be avoided due to the need to confirm the diagnosis of asthma using a validated spirometry and reversibility test, which was available only in secondary and tertiary centers.

Conclusions

Our study is the first multicenter, non-interventional, real-life study on newly diagnosed asthma patients in Turkey. The elderly asthmatics in our study had more frequent comorbidities, a higher follow-up rate, and better adherence to medications than the younger asthmatics. The high incidences of asthma and asthma-related morbidity and mortality in patients of an older age, along with the rapid aging of the population, leads us to believe that there is a need for further research on the various aspects of asthma in the elderly.

We believe that the results of this study and similar studies can help formulate an integrated management

plan for these patients. We support the “The Strategic Implementation Plan of the European Innovation Partnership on Active and Healthy Ageing” (EIP on AHA) (32) and the usage of mobile technology for the treatment of asthma and comorbidities (33).

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