Original Article

Clinical Features and Lung Functions of Asthma in Thai Elderly Patients

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Background: Asthma in the elderly is underdiagnosed and associated with a higher risk for morbidity and mortality.

Objective: To describe clinical features and lung functions of asthma in Thai elderly patients.

Materials and Methods: The authors extracted data from the electronic medical records at Thammasat University Hospital between 2015 and 2019. Asthmatic patients aged 18 years or older were included and divided into elderly, being 65 years or older and non-elderly groups being younger than 65 years.

Results: Two thousand three hundred ninety-nine patients were screened and 1,600 were eligible for the study with 72.6% female. The median (IQR) age was 54.0 years (44.0, 64.0). FEV_1 was 74.6% (61.3, 86.7). There were 410 patients (25.6%) in the elderly group, or a prevalence of 0.23% of all elderly patients. Compared to the non-elderly group, patients in the elderly group were more predominantly female, had lower prevalence of allergic rhinitis, but higher prevalence of hypertension and diabetes. The elderly group also had lower pre-bronchodilator FVC at 77.2% (62.1, 91.8) versus 81.2% (69.8, 91.6) (p=0.012), and pre-bronchodilator FEV_1 of 1.23 L (0.96, 1.53) versus 1.86 L (1.42, 2.34) (p<0.001). Only bronchodilator response in FVC was higher in the elderly group, compared to the non-elderly group at 9.2% (2.7, 17.1) versus 3.9% (0.0, 10.4) (p<0.001).

Conclusion: Asthma prevalence in Thai elderly patients at a university hospital was low. Elderlies with asthma had lower prevalence of allergic rhinitis, lower lung functions, but higher bronchodilator response compared to non-elderly patients. Future studies should investigate the effects of comorbid diseases and lung functions on asthmatic outcomes among elderly patients.

Keywords: Asthma; Elderly; Lung functions; Prevalence

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Asthma is a chronic inflammatory disease of the airway[1]. It is found in all age groups especially children and young adults. Genetic and environmental factors such as family history of atopy, cold air, allergens, cigarette smoke, and air pollution can provoke an immune response resulting in bronchi narrowing and chronic airway inflammation. Asthma symptoms include wheeze, shortness of breath, chest tightness and cough[1]. The diagnosis of asthma usually follows the Global Initiative for Asthma (GINA) guidelines based on symptoms, physical examinations, and pulmonary function test showing a response to a bronchodilator by spirometry[1].

Although asthma is more common in young populations, the prevalence of elderly people with asthma is increasing due to rising population and longer life expectancy. Many elderlies have asthma and suffer thus, there is an increase in morbidity and mortality[2,3]. Asthma in the elderly is underdiagnosed because of the patient's physiological, respiratory, and immune factors[4,5].

Asthma is prevalent in the elderly varying between 4.5% and 12.7%[6]. The prevalence of asthma in adults aged 65 years or older in the United States is 7%[7,8] and in other high-income countries is up to 10%[4,9]. It was found that elderly patients with asthma had higher hospital admission rates and longer hospital stays[2]. They also had more severe symptoms and higher mortality than younger patients[2,10]. The elderly with asthma often had at least one comorbid disease such as heart disease, chronic obstructive pulmonary disease (COPD), hypertension, or diabetes[11]. In addition, there are also common

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conditions in the elderly, such as amnesia, falls, low body mass index, dizziness, and abnormal vision. These problems affect daily activities[12]. Moreover, lung functions, especially forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC) in elderly patients with asthma, have decreased due to effects of normal aging on lung structure and function, as well as effects of pathophysiologic changes of asthma on respiratory system and lung functions[13]. These effects result in severe asthma symptoms and make asthma difficult to control[13].

Asthma in the elderly in Thailand has not been described. The present study aimed to determine the prevalence, clinical features, and lung functions of asthma in Thai elderly patients.

Materials and Methods

Study design and participants

A retrospective study was conducted. The data were extracted by using International Classification of Diseases (ICD-10) codes from the electronic medical records at Thammasat University Hospital between 2015 and 2019. The ICD-10 diagnoses of one of the following were included in the present study: J45.20, J45.21, J45.22, J45.30, J45.31, J45.32, J45.40, J45.21, J45.22, J45.30, J45.31, J45.32, J45.40, J45.41, J45.42, J45.50, J45.51, J45.52, J45.990, J45.991, and J45.998.

All patients aged 18 years or older diagnosed with asthma were included. Asthmatic patients were divided into elderly at 65 years or older, and non-elderly groups thus, younger than 65 years.

Ethic approval was obtained from the Human Research Ethics Committee of Thammasat University No.1 (Faculty of Medicine), Thailand (Project No. MTU-EC-IM-1-192/62, Certificate of Approval No.224/2019), in compliance with the Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and The International Practice (ICH-GCP). All methods were performed in accordance with these guidelines and regulations. The informed consent from participants were waived due to the retrospective chart review.

Procedures

Patient demographic data, clinical characteristics, comorbidity, exacerbation history, and medications were recorded. Laboratory data including pulmonary function test with a spirometry, complete blood counts including blood eosinophil count (BEC), chest X-ray, and computer tomography scan findings were collected.

Outcomes

The primary outcome was the prevalence of asthma in Thai elderly in Thammasat University Hospital. The prevalence was calculated by the numbers of elderly asthmatic patients divided by the total elderly population in Thammasat University Hospital between 2015 and 2019. The secondary outcomes were clinical characteristics and lung functions in asthmatic patients.

Statistical analysis

Based on a previous study[8], the prevalence of asthma among older people in the United States was 7%. The sample size was calculated using 80% power, 5% type I error, and 5% precision margin. Thus, the sample size would be 101.

Statistical analyses were performed using IBM SPSS Statistics, version 20.0 (IBM Corp., Armonk, NY, USA). Baseline characteristics were shown in number (%), mean ± standard deviation (SD), or median (interquartile range, IQR). Chi-squared test was used to compare categorical variables between the two groups. Independent sample t-test was used to compare continuous variables with normal distributions between two groups. The Mann-Whitney U test was used to compare between the two independent groups on continuous variables with non-normal distributions. A two-sided p-value less than 0.05 was considered statistically significant.

Results

Two thousand three hundred ninety-nine asthmatic patients aged 18 years or older were recruited. Of these, 1600 patients were eligible for the present study and 799 patients were excluded (Figure 1). There were 410 (25.6%) patients in the elderly group. During the 5-year study period, there were 179,829 patients aged 65 or more in the present study hospital. The prevalence of asthma in Thai elderly patients was 0.23%. Median (IQR) age of the patients was 54.0 years (44.0, 64.0). Mostly, they were female. Allergic rhinitis was the most common comorbidity. Common medications were inhaled corticosteroid (ICS) plus long-acting beta2 agonist (LABA) such as budesonide plus formoterol or fluticasone plus salmeterol, and ICS such as budesonide (Table 1). Pre-bronchodilator FEV_1/FVC was 76.9% (69.2, 83.8). Other lung function data are shown in Table 1.

When compared to the non-elderly group, patients in the elderly group were predominantly female, older, and had more comorbidities including

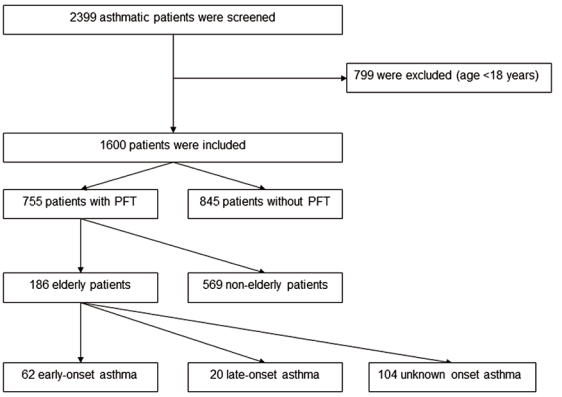

Figure 1. Flowchart of asthmatic patient recruitment to the study.

PFT=pulmonary function test

hypertension, diabetes, and dyslipidemia. However, the elderly group had lower prevalence of allergic rhinitis than the non-elderly group (Table 2). There were no significant differences in clinical history of asthma exacerbation between the elderly and the non-elderly groups (Table 2). For hematologic data, lower hemoglobin, hematocrit, and white blood counts were found in the elderly group, as well as lower BEC, as shown in Table 3. Pre-bronchodilator FVC and FEV_1 in the elderly group were significantly lower than in the non-elderly group. In addition, the elderly group had significantly higher bronchodilator response indicated by increased FVC and FEV_1 after bronchodilator testing, as shown in Table 4.

Discussion

The present study was the first retrospective study of a large numbers of people with asthma in Thailand, described the prevalence, clinical features, and lung functions of asthma in Thai elderly patients. It has been shown the prevalence of asthma in Thai elderly patients in Thammasat University Hospital was 0.23%. The present study prevalence was lower than the studies in USA, which had a prevalence of 7%[7,8]. The finding of the present study might be because the prevalence of asthma decreased while the prevalence of COPD increased with advancing age[8].

Elderly patients with asthma had high prevalence of comorbidities[3,12,14-16]. However, the study of Wardzynska et al showed that there was no correlation between the presence of comorbid conditions and the asthma control, severity, or frequency of exacerbations in older patients[14]. The study of de Roos et al from Netherlands showed that middle-aged and older adults with asthma had a significantly higher prevalence of obesity[17], which differed from the present study finding that the elderly group had non-significantly higher body mass index than the non-elderly group. The present study found that

Table 1. Demographics and baseline characteristics of asthmatic patients

Characteristics	Data (n=755)
Age (years); median (IQR)	54.0 (44.0, 64.0)
Body mass index (kg/m^2); median (IQR)	25.7 (22.8, 29.3)
Female; n (%)	539 (71.4)
Asthma diagnosis at age ≥65 years; n (%)	20 (2.6)
Family history of asthma; n (%)	47 (6.2)
Totally controlled asthma; n (%)	732 (97)
Former or current smokers; n (%)	63 (8.3)
Comorbidities; n (%)	
Allergic rhinitis	453 (60.0)
Nasal polyposis	24 (3.2)
Atopic dermatitis	24 (3.2)
Allergic conjunctivitis	14 (1.9)
Asthma-COPD overlap	13 (1.7)
Hypertension	248 (32.8)
Dyslipidemia	243 (32.2)
Diabetes	101 (13.4)
Clinical history of asthma exacerbation; n (%)	
AE <2 events	108 (14.3)
AE ≥2 events	34 (4.5)
AE with hospitalization <2 events	33 (4.4)
AE with hospitalization ≥2 events	5 (0.7)
AE with intubation <2 events	9 (1.2)
AE with intubation ≥2 events	2 (0.3)
Medications; n (%)	
Budesonide/formoterol	325 (43.0)
Fluticasone/salmeterol	298 (39.5)
Budesonide	67 (8.9)
Tiotropium	26 (3.4)
Theophylline	115 (15.2)
Doxofylline	15 (2.0)
Montelukast	329 (43.6)
Pulmonary function data; median (IQR)	
Pre-BD FVC (L)	2.22 (1.70, 2.83)
Pre-BD FVC (% predicted)	80.0 (86.1, 91.6)
Pre-BD FEV_1 (L)	1.68 (1.24, 2.15)
Pre-BD FEV_1 (% predicted)	74.6 (61.2, 86.4)
Pre-BD FEV_1/FVC (%)	76.9 (69.2, 83.8)
Pre-BD FEV_1/FVC (% predicted)	101.6 (92.0, 110.4)
FVC change after BD (%)	4.9 (0.5, 12.0)
FEV_1 change after BD (%)	7.2 (2.6, 15.2)

AE=asthma exacerbation; BD=bronchodilator; COPD=chronic obstructive pulmonary disease; FEV_1=forced expiratory volume in 1 second; FVC=forced vital capacity; IQR=interquartile range

Table 2. Comparison of demographics and baseline characteristics of asthmatic patients between elderly and non-elderly groups

Variables	Elderly (n=186); n (%)	Non-elderly (n=569); n (%)	p-value
Female	149 (80.1)	390 (68.5)	0.002
Age (years); median (IQR)	71.0 (66.0, 76.0)	50.0 (40.0, 57.0)	<0.001
Body mass index (kg/m^2); median (IQR)	26.3 (23.9, 29.3)	25.7 (22.8, 29.4)	0.197
Family history of asthma	6 (3.2)	41 (7.2)	0.138
Totally controlled asthma	178 (95.7)	554 (97.4)	0.452
Allergic rhinitis	94 (50.5)	359 (63.1)	0.002
Allergic conjunctivitis	2 (1.1)	12 (2.1)	0.364
Atopic dermatitis	2 (1.1)	17 (3)	0.148
Nasal polyposis	6 (3.2)	18 (3.2)	0.966
Asthma-COPD overlap	3(1.6)	10(1.8)	0.895
Hypertension	107 (57.5)	141 (24.8)	<0.001
Dyslipidemia	95 (51.1)	148 (26.0)	<0.001
Diabetes	45 (24.2)	56 (9.8)	<0.001
AE	29 (15.6)	113 (19.9)	0.164
AE with hospitalization	13 (7.0)	25 (4.4)	0.196
AE with intubation	2 (1.1)	9 (1.6)	0.617
Bronchodilator response	70 (37.6)	181 (31.8)	0.143
ICS/LABA use	158 (84.9)	488 (85.8)	0.783
ICS use	15 (8.1)	52 (9.1)	0.655
Xanthine use	38 (20.4)	92 (16.2)	0.181

AE=asthma exacerbation; COPD=chronic obstructive pulmonary disease; ICS=inhaled corticosteroid; LABA=long-acting beta2 agonist; IQR=interquartile range

Table 3. Comparison of hematologic data of asthmatic patients between elderly and non-elderly groups

Variables	Elderly (n=173)	Non-elderly (n=407)	p-value
Hemoglobin (g/dL); mean±SD	12.4±1.3	13.2±1.3	<0.001
Hematocrit (%)	37.8±4.0	40.1±3.8	<0.001
WBC (cells/μL); median (IQR)	6,900 (5,800, 8,600)	7,800 (6,300, 9,600)	<0.001
Neutrophil (%); median (IQR)	58.4 (52.2, 66.3)	59.1 (51.5, 66.8)	0.983
Lymphocyte (%); median (IQR)	28.8 (66.8, 34.3)	27.8 (21.9, 34.0)	0.905
Platelet (x10^3/μL); median (IQR)	236.0 (203.5, 283.0)	268.0 (215.0, 302.0)	0.006
BEC (cells/μL); median (IQR)	210.0 (91.8, 392.1)	253.5 (123.2, 439.9)	0.080

WBC=white blood counts; BEC=blood eosinophil counts; SD=standard deviation; IQR=interquartile range

Table 4. Comparison of pulmonary function data of asthmatic patients between elderly and non-elderly groups

Variables	Elderly (n=186); median (IQR)	Non-elderly (n=569); median (IQR)	p-value
Pre-BD FVC (L)	1.61 (1.27, 2.12)	2.41 (1.91, 2.96)	<0.001
Pre-BD FVC (% predicted)	77.2 (62.1, 91.8)	81.20 (69.8, 91.6)	0.012
Pre-BD FEV_1 (L)	1.23 (0.96, 1.53)	1.86 (1.42, 2.34)	<0.001
Pre-BD FEV_1 (% predicted)	74.6 (67.9, 83.4)	74.6 (62.0, 85.8)	0.381
Pre-BD FEV_1/FVC (%)	76.4 (67.9, 83.4)	77.0 (70.1, 84.0)	0.316
Pre-BD FEV_1/FVC (% predicted)	104.9 (94.3, 115.0)	101.0 (90.7, 109.5)	<0.001
FVC change after BD (%)	9.2 (2.7, 17.1)	3.9 (0.0, 10.4)	<0.001
FEV_1 change after BD (%)	8.4 (2.0, 16.9)	7.0 (2.7, 14.6)	0.346

BD=bronchodilator; FEV_1=forced expiratory volume in 1 second; FVC=forced vital capacity; IQR=interquartile range

half of the asthmatic patients had allergic rhinitis, hypertension, or dyslipidemia. Similar to the study of Ciprandi et al from Italy[18], the authors demonstrated that asthmatic patients in the elderly group had a significantly lower percentage of allergic rhinitis than those in the non-elderly group. However, the present study found significantly higher percentages of hypertension, dyslipidemia, and diabetes in the elderly group. These findings have not been established in the previous studies[3,8,9,14-17,19,20]. Moreover, the authors observed a trend towards lower BEC in the elderly group, but it did not achieve statistical significance. It may indicate that asthma in older patients had less prevalence of allergic and eosinophilic asthma phenotypes. ICS/LABA were used as the most common treatment in the present study (85%), which is similar to the study of Yanez et al from Argentina (84%)[15]. Percentage of the present study elderly patients with totally controlled asthma was 95.7%, compared with 26.3% in the study by Ciprandi et al[18].

Less than half of the present study asthmatic patients (47%) underwent pulmonary function testing, especially in the elderly group. The present study finding showed restrictive pattern indicated by a significantly lower FVC in the elderly group, compared to the non-elderly group. The present finding can be explained by a decrease in the expansion of the chest wall and degeneration of airways and alveoli with increasing age, as well as, reduced diaphragmatic function[5,21-23]. Elderly patients with asthma in the present study had lower FVC in the exacerbation with intubation group than those in the group without intubation. The present finding indicates that low lung functions were associated with poor asthma outcomes. Furthermore, the present study showed the elderly patients had significantly higher bronchodilator response of FEV_1 and FVC than the non-elderly patients. Previous studies of Bauer et al[24] and Heffler et al[25] found that higher bronchodilator reversibility indicated worse asthma control. Unlike younger patients with asthma, most elderly patients show incomplete reversibility[5]. Asthma death most often results from complications of irreversible obstruction, and most of these obstructions are in elderly patients[26]. These airway obstructions were not found in the present study. The authors found FEV_1/FVC of 76% in the elderly group and similar asthma exacerbation rates in the non-elderly group.

The present study had limitations. Firstly, the study was limited by its retrospective method. Only data available in the medical records were available for review. Secondly, because the study was held in a single research center in Thailand, the asthma prevalence might not represent the whole country. Thirdly, incorrect estimate of asthma prevalence in Thai elderly may occur due to comparing asthma numbers to total elderly patients in the hospital, which may not reflect the real population. Finally, the diagnosis of asthma remains a difficult clinical problem. Comorbid diseases in the elderly population and a tendency not to exhibit classic asthma signs and symptoms resulted in misdiagnosis of asthma.

Conclusion

Asthma prevalence in Thai elderly patients was low. Elderlies with asthma had lower prevalence of allergic rhinitis and lower lung functions. Interestingly, the elderly patients had higher bronchodilator response compared to the non-elderly patients. Future studies should investigate the effects of comorbid diseases and lung functions on asthma outcomes among elderly patients.

What is already known on this topic?

Asthma in the elderly is underdiagnosed with the prevalence varying between 4.5% and 12.7%. This condition is associated with a higher risk for hospital admission, longer hospital stay, and mortality. Asthma in Thai elderly patients has not been described.

What this study adds?

Asthma prevalence is low in Thai elderly patients. Elderly patients with asthma have high prevalence of hypertension and diabetes, but low prevalence of allergic rhinitis. Elderly patients with asthma have worse lung function compared to younger patients. High prevalence of bronchodilator reversibility is found in elderly patients with asthma.

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Conflicts of interest

The authors declare no conflict of interest.

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