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To cite this article: Andrzej Bozek, Jerzy Jarzab, Ewa Hadas, Marek Jakalski & Giorgio Walter Canonica (2018): Fall episodes in elderly patients with asthma and COPD – a pilot study., Journal of Asthma, DOI: [10.1080/02770903.2018.1474365](https://doi.org/10.1080/02770903.2018.1474365)

To link to this article: <https://doi.org/10.1080/02770903.2018.1474365>



Accepted author version posted online: 08 May 2018.



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Publisher: Taylor & Francis

Journal: *Journal of Asthma*

DOI: <https://doi.org/10.1080/02770903.2018.1474365>

Fall episodes in elderly patients with asthma and COPD – a pilot study.

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Running head: Falls episodes in elderly asthmatics.

Key words: epidemiology, morbidity and mortality

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Abstract

Objective: Evidence of an increased risk of falls in patients with chronic obstructive pulmonary disease (COPD) exists; however, this has not been studied in elderly asthmatic patients. The aim of the study was to determine the incidence of falls in elderly patients who were diagnosed with bronchial asthma compared to subjects with COPD.

Methods: A 12 – **month** prospective observational study in elderly **outpatients** with diagnosis of either asthma or COPD was conducted. All of the participants were monitored on the following parameters: falls, comorbidities, drug therapy and The Berg Balance Scale. The rate of falls was shown as an incidence ratio. Cluster analysis for subgroups with similar features was performed on all patients included in the study. Two clusters of frequent fallers were determined.

Results: The fall incidence rate in falls per person per year was 1.41 (95% CI: 0.86-1.96) in asthmatic patients and 1.49 (95% CI: 1.05-2.11) in the COPD group. Frequent fallers were more prevalent in the COPD group, with 32% in this group compared to 28% in the groups of patients with asthma.

In cluster analysis, frequent fallers were grouped into two models characterized by polytherapy, depression symptoms, hospitalizations, coronary disease, dementia and diagnosis of COPD or asthma.

Conclusion: Elderly asthmatic patients presented a high rate of falls, which is comparable to that of patients with COPD.

Introduction

Falls are a major problem for elderly people [1]. They frequently lead to the loss of independence and may be predictors of a shortened survival time in these patients [2]. The incidence of falls occurred in one-third of people over 65 years of age. [1]

There are many factors that contribute to falls, including age, gender, social, environmental and behavioral factors [1,3]. Most chronic diseases increase the risk of falls [1,2]. Additionally, drugs, and especially the use of polytherapy in older patients, can trigger falls [1,2].

Among such patients may be people with bronchial asthma. Elderly patients with asthma are an important and significant group of patients. They often have other illnesses, use many medications and have symptoms of depression and decreased quality of life. In addition, these patients are undiagnosed and untreated, which worsens their overall survival [3,4].

Data from the literature are not conclusive regarding the impact of bronchial obstructive diseases on the occurrence of falls and are mainly based on patients with chronic obstructive pulmonary disease (COPD) [4,5].

The aim of this preliminary study was to determine the incidence of falls in elderly patients who were diagnosed with bronchial asthma in comparison to subjects with COPD. The second aim was to define the features of typical frequent fallers with concomitant asthma.

Methods

Patients

We used the medical data of patients with asthma and with COPD, as a control group, from a national insurer in Poland. We invited randomly selected patients in this group with an asthma or COPD diagnosis from a group of 2466 patients. The reservoir sampling algorithm was used [6]. Then, we verified the diagnosis based on asthma criteria (GINA) or COPD criteria (GOLD) [7,8]. Patients with an unconfirmed diagnosis were excluded from the study (see the flow diagram of participants in Figure 1). The characteristics of the patients are presented in Table 1. The study was approved by the Local Bioethical Committee (Katowice, Poland). All participants signed informed consent.

Study design

A 12-month prospective observational study was performed. All of the participants were monitored between 2016 and 2017. The following procedures were carried out:

1. A confirmation of an asthma or COPD diagnosis. The diagnoses of asthma and COPD were based on the GINA and GOLD guidelines, respectively, as mentioned above. All of the patients had their lung function tested by spirometry, either prior to the study or during screening. The diagnosis of asthma was based on a medical history of asthma, physical examination and partial reversal of

airflow obstruction with a bronchodilator that resulted in a 12% or greater increase in forced expiratory volume in the 1st second (FEV1) after inhalation of 400 mcg of salbutamol. Patients who had episodic asthma were excluded.

2. An initial assessment that included physical function estimation, medical history, information about drug use, Mini-Mental State examination, and data about previous fall incidences. Additionally, spirometry was performed according to the ATS/ERS recommendation. The Berg Balance Scale was used as a clinical balance estimation [9,10,11]. This scale rates participant performance on 14 items involving static or dynamic tasks, with higher scores indicative of better balance [5].
3. The falls were recorded for 12 months in the patient's calendar diary.

All of the falls were also confirmed by telephone (caregiver, family, or patient). Any information about complications resulting in hospitalization or other medical interventions was monitored. The prevalence of falls and frequent fallers was analyzed. Falls were defined as unexpected events in which participants came to rest on the ground [12]. A frequent faller was defined as a patient who falls at least twice per year, in accordance with other authors [5,12].

4. A final assessment was carried out after 12 months that included medical history data such as drugs used, physical examination and spirometry.
5. Additionally, we considered three categories of ages: 65-79 years, 80-89 years, and 90+ years based on Stevens et al. criteria [13]

Statistical analysis

Descriptive analysis was used, and the Mann-Whitney U test was used to compare the groups of participants. The rate of falls was shown as an incidence ratio. The total number of falls reported by all participants was divided by the sum of person-years of observation, giving the mean number of falls per person per year of follow-up in the two groups analyzed. The incidence rate ratio is interpreted in a similar fashion to an odds ratio. Falls incidence rate ratios (frr) with 95% confidence intervals (CI) for

each individual predictor variable were presented. Univariate analyses were based on negative binomial regression, with falls as a dependent variable according to Iinattiniemi et al. [14]. In this analysis the following parameters were used: inhaled medications that were used for asthma or COPD by participants during observation, the total number of all used drugs in the same time, a number of comorbidities with the specification for their types, FEV1, categories of age and the results of Berg Balance questionnaire (described above).

The cluster analysis was performed on the basis of all patients included in the study to the final analysis (n=1576). In this study, to form models (clusters), all participants were grouped according to selected characteristics: diagnosis of asthma or COPD, incidence of hospitalization during the 12-month observation period, or the presence of coronary disease, diabetes, arterial hypertension, stroke, or depression symptoms. The result of such grouping was the creation of four different clusters. The k-means method was used [15]. Finally, we evaluated which cluster contained the most frequent fallers. The Statistica computer program version 8.2 (SaftPol, Cracow, Poland) was used. A p value of <0.05 was considered statistically significant.

Results

The fall incidence rate, as falls per person per year, was 1.41 (95% CI: 0.86-1.96) in asthmatic patients and 1.49 (95% CI: 1.05-2.11) in the COPD group. These results were comparable.

Falls were noticed in 373 (45%) patients with asthma (486 total fall events), which was comparable with 358 patients (48%) with COPD (502 total fall events). The univariate analysis of the dependence between the analyzed parameters and fall incidence rate ratios (frr) during the 12-month observation period revealed a significantly increased fall incidence rate ratios with the use of betamimetics, the presence of polymedication, most comorbidities (especially concomitant dementia) and advance age. The value of FEV1, results of Berg Balance score and presence of arterial hypertension did not have a strong connection with fall incidences. Detailed results are shown in table 2.

Frequent fallers

Frequent fallers were slightly more prevalent in the COPD group (239; 32%) compared to the group of patients with asthma (232; 28%), but the difference was not significant.

During clustering of all analyzed participants, four clusters were determined and are presented in table 3. Obtained clusters had the following characteristics:

In cluster 1, patients with asthma or COPD and with a predominance of coronary disease and diabetes were concentrated. In cluster 2, patients were especially characterized by a predominance of asthma, depression and polytherapy. In cluster 3, the participants had a predominance of COPD diagnosis, dementia, polytherapy, episodes of stroke, depression symptoms, hospitalizations and episodes of pneumonia. In cluster 4, a similar number of patients with asthma or COPD had problems with polytherapy and depression symptoms. Patients who were designated to be frequent fallers (ff) were especially concentrated in clusters 2 and 3.

Discussion

This is the first study to present prospective observations of fall episodes in patients with asthma in comparison to those with COPD. Particularly, the characteristics of older patients with asthma are important because such observations are lacking. Asthma patients are still confused with COPD patients [16]. In addition, they seem to have similar health conditions as older people with COPD. A few studies have shown differences in these patients, such as worse general health in COPD patients but more frequent episodes of depression in asthmatics [17,18,19].

Falls are an important predictor of complex health problems in older patients [1,14]. The search for a link between falls and the presence of various chronic diseases has been extensively studied [2,3,14].

The frequency of falls correlates with the age of the patient [1,20]. A significant increase in fall rates in patients older than 80 and 90 years is confirmed by earlier data [1,5]. The results show that falls are important in older asthma patients. Based on our results, COPD patients had worse overall health but a similar frequency of falls as the asthma group. This was particularly evident in the cluster analysis. Patients with COPD dominated in cluster 3, which was described by the presence of many serious diseases such as stroke, heart failure, etc.

This phenomenon can also be explained by the remaining results of the study, which is often explained by comorbidity or polytherapy. These factors are closely related to the risk of falls, which is confirmed by other references [1,2,3]. In both groups, dementia and mild cognitive impairments significantly increased falls incidences. This was earlier confirmed for COPD patients [1,5]. These mental disorders are still underdiagnosed in asthmatic patients [19].

Extremely interesting information is that betamimetics increase the frequency of falls in patients with asthma and COPD. However, this relationship may be affected by the fact that prescription of this medication is related to the severity of the disease. No such dependence has been observed before. It needs further investigation.

Frequent fallers are a special group of older patients. They are predisposed to severe medical events and death. There are many studies that have discussed this finding [1,3,21,22]. However, this is the first study about frequent falls in elderly asthmatic patients. The high incidence of frequent falls among patients with COPD has already been observed but never in asthmatics [4,5]. The cluster analysis showed that cluster 2, which focused on the largest group of asthmatics, included patients with depression symptoms, polytherapy and coronary diseases, as well as frequent hospitalization.

There were some limitations of this study. There was a compromise between the limited number of factors that were analyzed and the number patients tested. Many other geriatric scales were not used. We also excluded patients who had an overlap of asthma and COPD. However, it is very possible that such patients could be present in both groups: those with asthma and those with COPD. Therefore, further studies investigating the link between asthma, comorbidities and falls should be conducted.

Conclusion

Elderly asthmatic patients presented high rates of falls that are comparable with those of patients with COPD. Mental disorders significantly increased falls incidence in both groups. Some inhaled medicines may be important influences in provoking falls.

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Figure 1. Number of participants assessed for eligibility who completed the study.

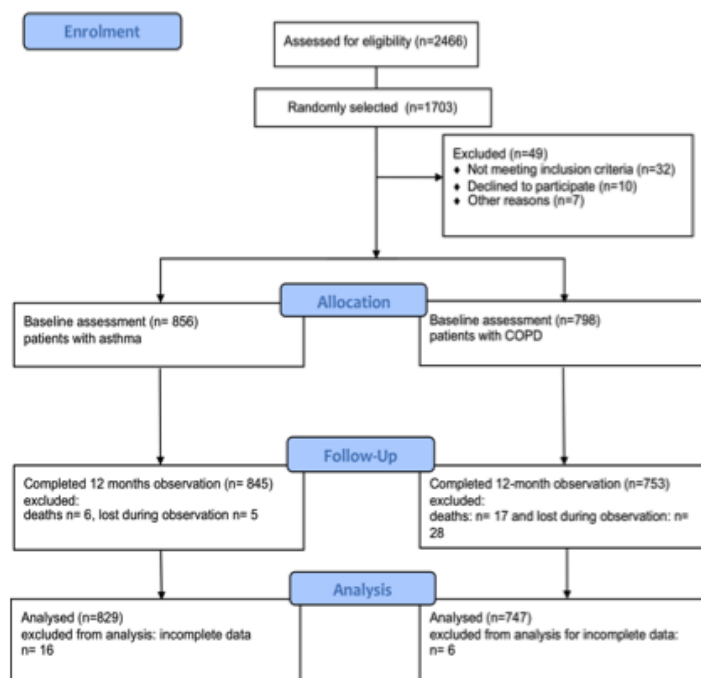


Table 1. Baseline characteristics of the study patients.

	Asthma group N=829	COPD group N=747	p
Age	71.3±9.3	69.1±7.8	NS
Female	433 (52%)	234 (31%)	0.0001
BMI	24.1±10.2	23.8±7.1	NS
Packs-years	16.8±8.3	52.1±19.4	0.001
FEV1 (% of predicted)	64.1±19.2	51.2±13.2	0.04

Legend: NS –not statistically significant, BMI – body mass index, FEV1 - forced expiratory volume in the 1st second

Table 2. Univariate analysis of fall incidence rate ratios and risk factors.

features	Asthma group frr (95% CI)	COPD group frr (95% CI)	p value
Medications	1.52 (1.19-2.05)		0.06
betamimetics	2.03 (1.73-2.76)	1.64 (1.21-2.23)	0.12
ICS			0.08
tiotropium	0.68 (0.19-1.21)	2.11 (1.67-3.21)	
polymedication (more than 5, any drug)		0.59 (0.21-1.13)	0.03
Comorbidities	-		
CAD	1.66 (0.98-2.04)	2.43 (1.45-3.22)	0.11
AH			0.06
Diabetes		1.96 (1.32-2.88)	0.21
Dementia			0.09
MCI	2.53 (1.34-3.17)		0.05
Depression			0.17
Berg Balance score	2.87 (1.53-3.72)	2.62 (1.32-3.20)	0.01
FEV1			0.06
65-79 yrs	1.01 (0.50-1.44)	2.94 (1.45-3.56)	0.23
80-90 yrs		0.88 (0.56-1.67)	0.14
+90 yrs	1.38 (1.02-1.87)		0.03
	4.32 (2.11-5.88)	1.47 (1.04-2.09)	
	2.78 (1.45-3.11)	4.87 (2.14-6.19)	0.05

	2.16 (1.63-2.82)	2.95 (1.77-3.27)	
	0.87 (0.32-1.56)	1.75 (1.43-2.13)	
	0.84 (0.51-1.44)	0.75 (0.34-1.19)	
	1.21 (0.56-1.88)	0.97 (0.34-1.21)	
	2.64 (1.45-3.83)	1.29 (0.60-1.76)	
	4.89 (2.54-8.49)	2.94 (1.74-4.12)	
		5.32 (1.87-7.34)	

Legend: frr - fall incidence rate ratios, ICS – inhaled corticosteroids, CAD – coronary arterial disease, AH – arterial hypertension, MCI –mild cognitive impairment, FEV1 - forced expiratory volume in the 1st second

Table 3. Cluster analysis from the whole population (n=1576).

features	Cluster 1 N=385	Cluster 2 N=431	Cluster 3 N=543	Cluster 4 N=217
ff	24.1	31.2	34.3	17.1
Asthma	23.1	40,1	21.2	19.4
COPD	15.1	13.1	38.2	20.1
dementia	19.8	20.3	39.3	17.4
polytherapy	18.8	33.5	32.1	27.5
coronary disease	33.1	23.5	36.5	14.2
hospitalization*	29.1	11.3	42.2	8.12
diabetes	14.2	11.2	17.9	12.7
stroke	11.5	13.12	35.8	10.6
depression	13.4	26.1	16.4	18.4
pneumonia	21.4	19.5	31.7	32.2

*Legend: ^The proportion of variables in each cluster are shown as percentages. All of the diseases were confirmed at the start of or during the 12-month of study observation. *Any hospitalization during the study observation period.*