Does gender affect asthma control in adult asthmatics?

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Abstract

Several studies have shown gender differences in prevalence of asthma but there is little information about asthma control. In this study, we aimed to evaluate the effect of gender on asthma control in adult asthmatics. Medical records of 242 patients older than 18 years of age who regularly visited the allergy unit were evaluated. Standardized asthma questionnaires like the asthma control test (ACT) were performed. ACT scores, clinical characteristics, and demographic data such as smoking status, education, duration and severity of asthma, atopic status, family history of asthma, analgesic hypersensitivity, number of emergency visits, and hospitalization in the previous year were compared based on gender. In this study, 77.3% of the patients were female. Mean age, body mass index, and duration of asthma were 39.0 ± 0.7, 27.3 ± 0.3, and 6.6 ± 0.4 years, respectively. Of the total, 14.9% of the patients were smokers. Also, 55.8% of them were graduated from middle school, 22.7% from high school, and 14% from university. Atopy rate was 57%. Analgesic hypersensitivity was found in 18.6% of them. There was 30.2% family history of asthma. The asthma severity was mild in 45.5%, moderate in 40.9%, and severe in 13.6% of the patients. One-third of the patients were admitted to emergency room; 1/10th were hospitalized due to asthma in the previous year. ACT scores indicated complete control in 67.8%, partial control in 17.8%, and uncontrolled asthma in 14.5%. Comparing the results of males with females having asthma, there was no statistically significant difference between the two gender according to ACT scores and clinical characteristics. Finally, the results conclude that there was no effect of gender on asthma control assessed with standardized questionnaire in adult asthmatics.

Keywords

Introduction

Asthma is a clinically heterogeneous disease caused by the complex interaction between genetic susceptibility and diverse environmental factors.[1] Gender-specific differences in asthma development have been suggested in a number of publications.[2] The relation between gender and asthma incidence depends on age. Childhood asthma tends to be a predominantly male disease, while the disease becomes more common in females.[3] The male disadvantage for asthma seems to disappear during puberty, but the underlying mechanism is unknown. Hormonal fluctuations, airway caliber, and bronchial hyperreactivity have been discussed as possible reasons for the gender differences.[4]

The goals of asthma management are to achieve and maintain control of the disease with minimal adverse effects of medication used. Standardized questionnaires like the asthma control test (ACT) is a validated scoring system including questions on daytime symptoms for asthma, night awakening,

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reliever inhaler use, and inability or difficulty performing normal activities.[5] Previous studies have demonstrated conflicting results in asthma control between the sexes. Possible factors that could explain worse asthma control are poorer compliance with prescribed therapies in women or hormone-related effects causing more asthma symptoms. Dijkstra et al.[6] have demonstrated that estrogen receptor 1 polymorphisms are associated with bronchial hyper-responsiveness and lung function decline, especially in female subjects. Other studies have shown that premenstrual or menstrual worsening of asthma can affect some females.

The aim of the present study is to investigate the effects of gender differences in asthma control in an adult population using the ACT.

Materials and methods

Study population

A total of 242 patients (187 females and 55 males) who already had regular follow-up at an outpatient allergy clinic during previous year were screened. Educational level, body mass index (BMI), atopic status, duration and severity of asthma, familial asthma history, presence of nasal polyposis, acetylsalicylic acid (ASA) hypersensitivity, and number of emergency department (ED) admissions and hospitalization in the previous year were recorded.

Asthma

Asthma was diagnosed by the presence of recurrent symptoms of wheezing, shortness of breath, cough, and demonstration of objective sign of reversible airway obstruction as stated by Global Initiative for Asthma guidelines.[1]

Body mass index

Body mass index (BMI) is expressed as the weight in kilograms divided by the square of the height in meters.

Atopy evaluation

Atopy is defined as a positive skin prick test to at least one of the aeroallergens. Glycerinated extracts (Stallergenes, Antony, France) of the following allergenic sources were used in skin prick tests: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, cockroach, grass, tree, weed pollens, cat, dog, *Alternaria*, and *Cladosporium*

antigens. Positive (histamine: 10 mg/ml) and negative (saline solution) controls were included. The puncture method with a 1-mm tip disposable lancet was used, and a wheal reaction with a mean diameter of 3 mm greater than the negative control was considered a positive response.

Asthma control measures

A validated ACT was completed, recording five questions about asthma in the past 4 weeks on a 5-point scale.[7] The items are equally weighted and the maximal total score is 25. ACT score ≤15 was accepted as uncontrolled asthma, between 16 and 19 as partially controlled asthma, and ≥20 as well-controlled asthma.

Analysis

A statistical analysis was performed using Statistical Package for Social Sciences statistics software for Windows, Version 20.0 (IBM Corporation, Armonk, New York, USA). Nominal values were expressed as n (%), and numerical variables were expressed as the mean $\pm$ standard error. The interactions between gender and asthma control scores and admission to ED and hospitalization for asthma were tested using χ^2 test. The value of $p < 0.05$ was considered as significant. Logistic regression analysis was performed to find out the factors associated with asthma control status.

Results

The characteristics of the study group and asthma are shown in Table 1. The mean age was 39.0 ± 0.7 years (17–67 years), and of the 242 patients, 187 were female. Duration of asthma was 6.6 ± 0.4 years. In all, 14.9% of patients were smokers; 55.8% of them were graduated from middle school and 36.8% from high school or university. Atopy rate was 57.0%. The asthma severity was mild in 45.5%, moderate in 40.9%, and severe in 13.6% of the patients. One-third of the patients were admitted to emergency room; 1/10th were hospitalized due to asthma in the previous year. ACT scores indicated complete control in 67.8%, partial control in 17.8%, and uncontrolled asthma in 14.5%. There were no significant differences between females and males for age, duration and severity of asthma, familial asthma history, ASA hypersensitivity, presence of nasal polyposis, or atopy (Table 2). Educational level (more university graduates) and BMI levels (27.8 vs. 25.4 kg/m^2) were higher

Table 1. Clinical characteristics of the study group.

n	242
Gender[a]	
Female	187 (77.3)
Male	55 (22.7)
Age (year)[b]	39.0 ± 0.7 (17-67)
BMI[b]	27.3 ± 0.3 (18-42)
Smoking status (nonsmoker/ex-smoker/ current smoker)[a]	173 (71.5)/33 (13.6)/36 (14.9)
Educational level[a]	
None	18 (7.4)
Primary + secondary school	135 (55.8)
High school	55 (22.7)
University	34 (14.0)
Disease duration (year)[b]	6.6 ± 0.4 (1–32)
Familial asthma story	
None	169 (69.8)
First-degree relatives	56 (23.1)
Second-degree relatives	17 (7.0)
Atopy[a]	
None	104 (43.0)
Monosensitized	59 (24.4)
Polysensitized	79 (32.6)
Sinonasal polyps[a]	49 (20.2)
ASA hypersensitivity[a]	45 (18.6)
Disease severity[a]	
Mild	110 (45.5)
Moderate	99 (40.9)
Severe	33 (13.6)
Asthma control status[a]	
Well controlled	164 (67.8)
Partially controlled	43 (17.8)
Uncontrolled	35 (14.5)
Admission to ER[a]	
Previous year (1–10)	81 (33.5)
During disease process	113 (46.7)
Hospitalization for asthma[a]	
Previous year(1–4)	25 (10.3)
During disease process	43 (17.8)

BMI: body mass index; ER: emergency room; ASA: acetylsalicylic acid.
[a]Numbers (percentages).
[b]Mean ± standard deviation (range).

in females ($p < 0.05$). Although smoking rate (30.9% vs. 10.2%) was higher in males, smoking pack-years were not different between females and males. ACT scores were similar in both genders. There was no statistically significant difference between females and males in terms of admission to ED and hospitalization for asthma for both genders in the previous year and during the disease process (Table 2).

Sex, BMI, age, smoking, educational levels, familial asthma history, presence of nasal polyposis, atopic status, duration and severity of asthma, and ASA hypersensitivity were further entered into logistic regression analysis to determine independent predictors of controlled asthma. Partially controlled and controlled asthma groups were combined (ACT score >15) to perform this analysis. In logistic regression analysis (method = Enter), independent predictive factors for determining controlled asthma were calculated as disease duration (relative risk (RR) = 1.1, 95% confidence interval (CI) = 1.0–1.2) and the presence of severe asthma (RR = 9.6, 95% CI = 2.6–35.8). Gender difference did not influence asthma control.

Discussion

The goal of asthma management is to achieve clinical control of the disease and of its risks.[1] Clinical trials showed that a guideline-defined control of asthma can be achieved in the majority of patients with appropriate treatment.[8] Lack of adherence to medications is the most common reason for poor asthma control among many factors.[5] Sex-specific approaches to asthma assessment are lacking in current guidelines focus on assessing asthma control.[9] In this respect, the presented article sought the effect of gender on asthma control in asthmatics, who were followed up by an asthma referral center for at least 1 year and demonstrated no important differences in asthma control.

Previous studies have demonstrated differences between the sexes in asthma symptoms and control. Women frequently report worse asthma-related quality of life despite demonstrating better pulmonary function and, greater health care utilization than men.[10,11] Having higher BMI may complicate asthma control and quality of life, independently of age, gender, and asthma severity.[12] Kattan et al.[13] showed that obese female adolescent asthmatics suffered poor asthma control. One recent study showed that worse asthma control is associated with increased BMI in boys but varied among girls.[14] Lang et al.[15] reported that obesity did not affect asthma control, but obesity in males was found to be associated with greater airflow obstruction; among females, obesity was associated with improved lung function and reduced airway reactivity to methacholine in childhood. On the other hand, the Real-world Evaluation of Asthma Control and Treatment study is reported that predictors of

Table 2. Gender effect on demographic and clinical parameters.

	Female patients	Male patients	*p* Value
n	187	55	
Age[a]	39.6 ± 11.5	37.0 ± 11.9	0.14
Disease duration (year)[b]	4 (1–32)	5 (1–20)	0.64
Familial asthma story[c]			0.40
None	127 (67.9)	42 (76.4)	
First-degree relatives	47 (25.1)	9 (16.4)	
Second-degree relatives	13 (7.0)	4 (7.3)	
ASA hypersensitivity[c]	34 (18.2)	11 (20.0)	0.76
Sinonasal polyps[c]	35 (18.7)	14 (25.5)	0.27
Atopy[c]			0.99
None	80 (42.8)	24 (43.6)	
Monosensitized	46 (24.6)	13 (23.6)	
Polysensitized	61 (32.6)	18 (32.7)	
Educational level[c]			0.007
None	17 (9.1)	1 (1.8)	
Primary + secondary school	107 (57.2)	28 (50.9)	
High school	34 (18.2)	21 (38.2)	
University	29 (15.5)	5 (9.1)	
BMI[b]	28 (18-42)	25 (18-36)	0.003
Severity[c]			
Mild	87 (46.5)	23 (41.8)	0.52
Moderate	77 (41.2)	22 (40.0)	
Severe	23 (12.3)	10 (18.2)	
Asthma control status[c]			0.28
Well controlled	127 (67.9)	37 (67.3)	
Partially controlled	36 (19.3)	7 (12.7)	
Uncontrolled	24 (12.8)	11 (20.0)	
Admission to emergency department[c]			
Previous year (1–10)	60 (32.1)	21 (38.2)	0.4
During disease process	85 (45.4)	28 (50.9)	0.476
Hospitalization for asthma[c]			
Previous year (1–4)	17 (9.1)	8 (14.5)	0.24
During disease process	30 (16.0)	13 (23.6)	0.195

ASA: acetylsalicylic acid; BMI: body mass index.
[a]Mean ± standard deviation.
[b]Median (range).
[c]Numbers (percentages).

uncontrolled asthma despite the use of standard asthma medications in accordance with currently accepted guidelines were younger age, Hispanic ancestry, male gender, lower income, and lower education and comorbidities such as chronic sinusitis, high blood pressure, and gastroesophageal reflux disorder.[16] On the contrary, McCallister et al.[9] recently stated that using the overall score alone on currently available asthma questionnaires may not detect sex-specific differences in asthma symptoms. This study provided preliminary data suggesting no gender effect on asthma control. Including regular follow-up of patients with asthma by the referral center may be considered as the main reason for this difference in contrast to other studies.

It is important to consider atopic status when assessing the factors of relevance for the development of allergic disease such as asthma. Atopy is another factor also affecting control of asthma. Accordini et al.[17] found increased risk of a heavy burden for nonatopic females compared with nonatopic males. But a recent study revealed that there was no significant difference between atopic and nonatopic patients in asthma symptoms, quality of life, frequency of patients with uncontrolled asthma, emergency room visit, hospital admission, airway obstruction, and response to treatment.[18] The

presented study also demonstrated similar results showing no link between atopy and asthma control, regardless of whether gender is taken into account.

There have been major advances in the past decade in our understanding of the genetics, natural history, and pathogenesis of the diverse clinical syndromes identified as asthma. But it is not clear why women have been consistently shown to suffer from worse asthma control than men. Lately, the data revealed that gender had no effect on asthma control, but symptom perception might have had gender-specific variation as in the presented study.[9]

We confirm that there are limitations to our study due to the retrospective analysis of the data and due to the small patient group from a single institution.

Conclusions

In conclusion, our study demonstrates that clinical control of asthma assessed with a standardized and validated questionnaire is not associated with gender. Further research needs to be undertaken to elucidate the role of gender on several domains of asthma control.

Conflict of interest

This is not an industry-supported study. The authors have indicated no conflicts of interest.

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References

1. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. Report, GINA, 2006.
2. van Merode T, Maas T, Twellaar M, et al. Gender-specific differences in the prevention of asthma-like symptoms in high-risk infants. *Pediatr Allergy Immunol.* 2007; 18: 196–200.
3. Tollefsen E, Langhammer A, Romundstad P, et al. Female gender is associated with higher incidence and more stable respiratory symptoms during adolescence. *Respir Med* 2007; 101: 896–902.
4. Nicolai T, Illi S, Tenborg J, et al. Puberty and prognosis of asthma and bronchial hyper-reactivity. *Pediatr Allergy Immunol* 2001; 12: 142–148.
5. National Asthma E and Prevention P. Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007. *J Allergy Clin Immunol* 2007; 120: S94–S138.
6. Dijkstra A, Howard TD, Vonk JM, et al. Estrogen receptor 1 polymorphisms are associated with airway hyperresponsiveness and lung function decline, particularly in female subjects with asthma. *J Allergy Clin Immunol* 2006; 117: 604–611.
7. Uysal MA, Mungan D, Yorgancioglu A, et al. The validation of the Turkish version of asthma control test. *Qual Life Res* 2013; 22: 1773–1779.
8. O'Byrne P. Asthma control. In: Akdis C and Agache I (eds) *Global Atlas of asthma*. European Academy of Allergy and Clinical Immunology, 2013, pp. 130–131.
9. McCallister JW, Holbrook JT, Wei CY, et al. Sex differences in asthma symptom profiles and control in the American lung association asthma clinical research centers. *Respir Med* 2013; 107: 1491–1500.
10. Wijnhoven HA, Kriegsman DM, Snoek FJ, et al. Gender differences in health-related quality of life among asthma patients. *J Asthma* 2003; 40: 189–199.
11. Sinclair AH and Tolsma DD. Gender differences in asthma experience and disease care in a managed care organization. *J Asthma* 2006; 43: 363–367.
12. Lavoie KL, Bacon SL, Labrecque M, et al. Higher BMI is associated with worse asthma control and quality of life but not asthma severity. *Respir Med* 2006; 100: 648–657.
13. Kattan M, Kumar R, Bloomberg GR, et al. Asthma control, adiposity, and adipokines among inner-city adolescents. *J Allergy Clin Immunol* 2010; 125: 584–592.
14. Borrell LN, Nguyen EA, Roth LA, et al. Childhood obesity and asthma control in the GALA II and SAGE II studies. *Am J Respir Crit Care Med* 2013; 187: 697–702.
15. Lang JE, Holbrook JT, Wise RA, et al. Obesity in children with poorly controlled asthma: sex differences. *Pediatr Pulmonol.* 2013; 48: 847–856.
16. Peters SP, Jones CA, Haselkorn T, et al. Real-world Evaluation of Asthma Control and Treatment (REACT): findings from a national Web-based survey. *J Allergy Clin Immunol* 2007; 119: 1454–1461.
17. Accordini S, Corsico A, Cerveri I, et al. The socioeconomic burden of asthma is substantial in Europe. *Allergy* 2008; 63: 116–124.
18. Ponte EV, Souza-Machado A, Souza-Machado C, et al. Atopy is not associated with poor control of asthma. *J Asthma* 2012; 49: 1021–1026.