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TANAFFOS

Relationship between Metabolic Syndrome Components and Severity of Asthma in Outpatients Referring to Alzahra Hospital Clinic

Mohammad Emami-Ardestani [1], Ghazaleh Sajadi [2]

[1] Department of Internal Medicine, Pulmonary Division, AL-Zahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran, [2] Isfahan Internal Medicine Research Center, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

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Correspondence to: Sajadi G
Address: Isfahan Internal Medicine Research Center, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran
Email address: dr.gh.sajadi@gmail.com

Background: Metabolic syndrome is the most common problem worldwide associated with numerous complications. Some studies indicated that metabolic syndrome is associated with asthma; therefore, this study aimed to investigate the possible relationship between metabolic syndrome components and severity of asthma in outpatients referring to Alzahra Hospital in Isfahan, Iran.

Materials and Methods: This descriptive cross-sectional study was performed on 200 patients with asthma referring to Alzahra Lung Clinic in Isfahan, Iran, within 2018-2020. The severity of asthma was evaluated by the Guidelines for the Diagnosis and Management of Asthma by the National Institutes of Health. The association between different categories of asthma severity and metabolic syndrome was investigated.

Results: The patients were divided into four categories according to the severity of asthma, including intermittent (n=63), mild (n=63), moderate (n=56), and severe (n=18). Moreover, 38.5% (n=77) of patients had metabolic syndrome, and there was no significant relationship between different categories of asthma severity and metabolic syndrome (P=0.73).

Conclusion: The prevalence of metabolic syndrome is high among patients with asthma; however, there was no significant relationship between metabolic syndrome and different categories of asthma severity.

Key words: Asthma; Metabolic syndrome; Severity; Pulmonary function test

INTRODUCTION

Asthma is a high-prevalence, heterogeneous, and chronic lung inflammatory disease with an estimated prevalence of 250 million individuals worldwide (1). This obstructive disease is characterized by reversible airway obstruction, bronchospasm, and clinical symptoms of varying severity over time (2). Asthma co-occurs with various diseases, including numerous metabolic, mental, cardiovascular, and other disorders (3). Insulin resistance and resulting metabolic imbalance affect lung function in different ways. Insulin-like growth factor 1 affects the smooth muscle contraction of the airway wall (4, 5) and stimulates the proliferation of these cells (6). Some studies indicated that diabetes (insulin resistance) and obesity increase the risk of asthma which is proportional to its severity and is a risk factor for insulin resistance and metabolic syndrome (7-9), where metabolic syndrome is a risk factor for asthma (10). Metabolic syndrome is an important problem in internal medicine (11), the incidence rate of which increases with getting older, especially older than 50 years (12,13). Some studies indicated an association

between obstructive lung diseases, such as asthma, with metabolic syndrome (14), and the mechanism of this association is unknown.

Therefore, the present study aimed to investigate possible relationships between metabolic syndrome components and severity of asthma in outpatients referring to Alzahra Hospital in Isfahan, Iran.

MATERIALS AND METHODS

This descriptive cross-sectional study was performed on 200 patients with asthma referring to Alzahra Lung Clinic in Isfahan, Iran, within 2018-2020. All protocols in this study have been approved by the Ethics Committee of Isfahan University of Medical Sciences. The inclusion criteria included patients with asthma, diagnosed by a pulmonologist who is an expert in spirometry, age of over 18 years, and consent to participate in the study. The exclusion criteria also included other pulmonary diseases and inflammatory and infectious diseases; however, if the patient withdrew during the study or did not refer for follow-up was not considered. In the current study, a checklist was prepared, including full information about age, gender, weight, height, and body mass index (BMI). The stage of the disease was determined using the criteria available in the Guidelines for the Diagnosis and Management of Asthma by the National Institutes of Health (15) (based on the forced expiratory volume in 1 second [FEV1], forced vital capacity [FVC], and FEV1/FVC). With considering daytime symptoms, nocturnal symptoms, use of beta-agonists to relieve acute symptoms, impaired daily activity, and spirometry, asthma severity was divided into four categories as follows:

1- **Intermittent:** This group has no disruption in daily work, less or equal to twice a week, while requiring the use of short-acting beta-agonists, no nighttime symptoms, FEV1 above 80%, and normal FEV1/FVC.
2- **Mild Persistent:** This group has a slight restriction on daily work, signaling more than twice a week but neither daily nor more than once a day, and inevitable use of short-acting beta-agonists. Three to four times have nighttime symptoms throughout the month. The FEV1 is higher than or equal to 80% and normal. The FEV1/FVC is also normal.
3- **Moderate Persistent:** This group is moderately restricted in daily tasks, signaling daily, and inevitably affected by the use of short beta-agonists. They have nighttime symptoms more than once a week but not every night. The FEV1 is within the range of 80-60%. The FEV1/FVC also decreases by about 5%.
4- **Severe Persistent:** This group is severely restricted in day-to-day work, signaling several times a day, forced to use short-acting beta-agonists, and having nighttime symptoms each night. The FEV1 is less than 60%. The FEV1/FVC is also decreased by more than 5%.

After determining the severity of the disease in patients with metabolic syndrome, the risk factors were evaluated based on modified Adult Treatment Panel III criteria (16), including fasting blood sugar (FBS>100) and obesity, especially abdominal obesity (waist circumference [WC] above 102 and 88 cm in male and female subjects, respectively). Hypertension was elevated (systolic blood pressure [SBP] above 130 or diastolic blood pressure [DBP] above 85). In addition, the elevated lipid profile (high-density lipoprotein [HDL]) was under 50 and 40 in male and female subjects, respectively (where triglyceride [TG] was above 150). If a patient had three of the aforementioned complications (3 of 5), the patient was diagnosed with metabolic syndrome.

The SPSS software (version 20; IBM, USA) was used for statistical analysis. The quantitative data were expressed in mean and standard deviation, and the qualitative data were expressed based on frequency and percentage. The Chi-square test was used to compare the qualitative variables. The independent t-test and one-way analysis of variance were also used to associate the quantitative data with the qualitative data. Moreover, Pearson correlation was also used to compare the quantitative variables. P-values less than 0.05 were considered statistically significant.

RESULTS

The study was performed on 200 asthma patients, including 91 male and 109 female subjects. The patients' mean values of age, BMI, and WC were reported as 42.76±15.62 years, 26.13±5.28 kg/m², and 93.70±12.33 cm, respectively. The patients were divided into four categories according to the severity of asthma, including intermittent (n=63), mild (n=63), moderate (n=56), and severe (n=18). There was no significant difference between different categories of asthma severity in terms of age, gender, BMI, and waist size (P>0.05). The mean values of SBP and DBP in patients were 124.40±16.01 and 79.05±10.06 mmHg, respectively. There was no significant difference between different categories of asthma severity based on SBP and DBP (P>0.05). On the other hand, the patients' mean TG, HDL, and FBS values were 131.92±49.61, 42.67±9.96, and 107.39±36.48, respectively. There was no significant difference between different categories of asthma severity based on TG, HDL, and FBS (P>0.05). The patients' mean FVE1, FVC, and FEV1/FVC values were 62.73±10.70, 103.37±13.86, and 0.61±0.11, respectively (Table 1).

According to the results of this study, 38.5% (n=77) of patients had metabolic syndrome, and there was no significant relationship between different categories of asthma severity and metabolic syndrome (P=0.73). According to Pearson correlation, there was no significant relationship between FEV1, FVC, and FEV1/FVC with the studied variables, including age, BMI, WC, SBP, DBP, TG, HDL, and FBS (P>0.05; Table 2). There was no significant difference between patients with and without metabolic syndrome based on age and gender (P>0.05). There was also no significant difference between the two groups in FEV1, FVC, and FEV1/FVC (P>0.05; Table 3).

Table 1. Variables of study based on severity of disease in patients with asthma

Variables	Severity of disease				Total	P-value
	Intermittent	Mild	Moderate	Severe		
Gender (m/f)	20/43	31/32	30/26	10/8	91/109	0.06**
Age	41.40±16.21	44.04±16.61	40.82±14.96	46.10±14.59	42.76±15.62	0.32*
BMI	25.36±4.61	27.11±4.88	25.54±5.41	26.93±6.18	26.13±5.28	0.23*
WC	93.04±10.40	94.06±10.94	91.65±14.40	92.35±11.42	93.70±12.33	0.42*
SBP	120.10±15.06	127.17±17.69	124.53±14.84	126.37±16.36	124.40±16.01	0.13*
DBP	79.50±7.90	80.65±7.11	78.75±9.25	77.12±15.31	79.05±10.06	0.42*
TG	123.14±30.16	130.30±30.09	129.03±35.58	151.36±93.01	131.92±49.61	0.10*
HDL	43.95±11.16	42.64±8.10	42.62±8.91	40.85±12.42	42.67±9.96	0.65*
FBS	103.42±33.25	104.95±34.59	113.11±40.56	105.90±35.93	107.39±36.48	0.52*
FEV1	-	-	-	-	62.73±10.70	-
FVC	-	-	-	-	103.37±13.86	-
FEV1/FVC	-	-	-	-	0.61±0.11	-
Metabolic syndrome	27 (42.9%)	22 (34.9%)	20 (35.7%)	8 (44.4%)	77 (38.5%)	0.73

BMI: body mass index, WC: waist circumfere0nce, SBP: systolic blood pressure, DBP: diastolic blood pressure, TG: triglycerides, HDL: High-density lipoprotein, FBS: fasting blood sugar, *One-way ANOVA, **Chi Square

Table 2. Correlation between pulmonary function tests and metabolic syndrome variables

Correlation		Age	BMI	WC	SBP	DBP	TG	HDL	FBS
FEV1	r	-0.08	-0.08	0.04	0.09	0.19	0.64	-0.01	-0.04
	P	0.64	0.58	0.33	0.45	0.19	0.36	0.64	0.87
FVC	r	0.09	-0.01	0.08	0.07	0.24	0.36	0.07	-0.08
	P	0.33	0.46	0.09	0.66	0.99	0.34	0.47	0.74
FEV1/FVC	r	-0.15	-0.20	-0.19	-0.10	0.02	0.03	-0.08	-0.16
	P	0.36	0.38	0.44	0.75	0.78	0.68	0.39	0.69

Table 3. Demographics and pulmonary function tests based on metabolic syndrome

Variables	Metabolic syndrome		P-value
	No	Yes	
FEV1	62.55±10.29	63.01±11.36	0.55*
FVC	103.45±13.32	103.25±14.72	0.89*
FEV1/FVC	0.63±0.11	0.61±0.12	0.11*

*Independent t test

DISCUSSION

The current study indicated that 38.5% of patients with asthma had metabolic syndrome, which is a relatively high rate. However, no significant relationship was observed between metabolic syndrome factors and pulmonary function tests with the severity of asthma in patients. Serafino-Agrusa et al. indicated that asthma and metabolic syndrome are epidemiologically linked. Furthermore, by the assessment of the components of metabolic syndrome, they showed that obesity might be a predisposing factor for asthma. They assumed that there might be a relationship between different factors of metabolic syndrome, especially obesity and hypertension, with the severity of asthma; however, they suggested that specifically designed studies are required to address this issue (14). The results of the aforementioned study are not similar to the current study's conclusion because the present indicated no significant relationship between metabolic syndrome and severity of asthma; nevertheless, the prevalence of metabolic syndrome among patients with asthma was high, compared to the general population with the incidence of 38.5%.

Del-Rio-Navarro et al. carried out a survey on 174 patients with asthma and 269 patients without asthma and showed that metabolic syndrome is more prevalent among obese patients with asthma. Furthermore, it was demonstrated that there is a significant relationship between asthma and metabolic syndrome (17). The incidence of metabolic syndrome in asthma patients in the present study was 38.5%, and there was no significant relationship between pulmonary function tests of patients with metabolic syndrome.

Another study by Garmendia et al. was performed on the relationship between asthma and metabolic syndrome. They confirmed the issue that metabolic syndrome might be more prevalent among asthma patients. The aforementioned study concluded that a higher prevalence of metabolic syndrome in asthma patients could be due to endocrinal issues and suggested that endocrinal management should be considered, along with asthma controls (18). The incidence of metabolic syndrome in asthma patients in the current study was higher than in the general healthy population.

Aydin et al., in a study performed on 75 postmenopausal women, suggested adipokines and altered glucose metabolism as possible factors that could affect the distribution of metabolic syndrome in asthma patients (19). The mean of FBS in the current study was higher than 100, and FBS and some lipids were impaired in most patients; therefore, impaired glucose and lipid metabolism should be considered in patients with asthma and metabolic syndrome.

Lugogo et al. also carried out a study on the relationships between metabolic syndrome and asthma in different studies. They emphasized the higher prevalence of metabolic syndrome and its factors in asthma patients and assumed that metabolic dysregulation and oxidative stress, along with obesity, are possible basic reasons for this issue (20). The aforementioned studies are somehow in line with the present study. This study showed a high prevalence of metabolic syndrome in patients with asthma which might be due to the mentioned mechanisms. Forno et al. investigated pulmonary function tests, metabolic syndrome, and insulin resistance and reported that metabolic syndrome and insulin resistance were associated with decreasing lung functions, especially in obese adults. Additionally, they suggested that further studies should be performed to assess the associations of the aforementioned factors with asthma and its pathogenesis (21).

CONCLUSION

Based on the results of the current study and other studies, the prevalence of metabolic syndrome in patients with asthma might be higher than in the general population. Moreover, there might be a correlation between asthma and metabolic syndrome. This issue was discussed in different lines of evidence, and endocrinal and

oxidative stress factors were supposed to cause this issue. On the other hand, some studies believe that further investigations should be performed to examine different components of metabolic syndrome and asthma. The present study showed no significant relationship between the factors of metabolic syndrome with the severity of asthma and pulmonary function tests.

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