ORIGINAL ARTICLE

Evaluating Status of Asthma Control and Quality of Life Based on Demographic Variables in Patients with Asthma

Running Title: Asthma Control

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ABSTRACT

Introduction: Asthma is one of the most common chronic diseases in the world. Poor asthma control leads to asthma exacerbation and increases the cost of treatment. This study aimed to investigate the status of asthma control, quality of life in asthmatic patients, medication adherence, and their association with demographic variables such as age, gender, and body mass index (BMI), smoking, and level of education. **Materials and Methods**: The current descriptive cross-sectional study was conducted on 200 randomly selected asthmatic volunteers referred to the Lung clinic in Yazd, Iran, from 2018 to 2019, who were examined by the Asthma Control Test (ACT). The asthma control association was checked with age, gender, BMI, educational level, and smoking. Data were analyzed by Fisher's exact test, independent t-test, paired t-test, chi-square, and ANOVA. **Results**: According to ACT data, asthma was uncontrolled in 28 (14%), partially controlled in 144 (72%), and completely controlled in 28 (14%) asthmatic volunteers. There was no significant association between asthma control and any of the variables. Based on the GINA 2016 guidelines, asthma was uncontrolled in 62 (31%), partially controlled in 105 (52.5%), and completely controlled in 33 (16.5%). There was a significant association between asthma control with age (P=0.037) and smoking in the last six months (P=0.029). The quality of life was reported as good in 2 (1%), moderate in 197 (98.5%), and poor in 1 (0.5%). The association between quality of life and smoking was significant (P=0.002). The adherence to asthma medication was good in 30 (15%), moderate in 166 (83%), and poor in 4 (2%). The association of medication adherence with demographic variables was not significant. **Conclusion**: The asthma was completely controlled in less than 50% of patients and partially controlled or uncontrolled in more than 50% of patients. Patients with asthma should be trained in the area of complete control.

INTRODUCTION

Chronic diseases are a broad range of conditions that reduce a patient's adaptability due to its long course and develop physical and psychological restrictions. Asthma is one of the most common chronic diseases, affecting approximately 5 million people worldwide, and has been increasing in the last five years (1). There are 5 million asthma cases registered in Europe alone and asthma prevalence varies from 2.3% in Switzerland to 18.4% in Scotland. In France, this is estimated at about 6.7% of the population (2). In the United States, asthma accounts for 5-10% of the population, or about 23.4 million, of which 7 million are children (3). The Asthma death rate in some countries is around 0.86/100,000; in the United States, 1/100,000 deaths

were recorded in 2009. Mortality is primarily associated with lung function, which is especially increased in young patients with uncontrolled asthma. Other factors contributing to mortality include age over 40, smoking more than 20 packs per year, blood eosinophilia, and FEV1 of 40-60% (4).

Asthma is a syndrome characterized by spontaneous and treatable airflow obstruction, reversible episodes of wheezing, chest tightness, shortness of breath, and nighttime cough. The airflow obstruction is usually reversible in asthma, but some patients with chronic asthma show a percentage of irreversible airflow obstruction (5). The pathophysiology of asthma is complex and involves airway inflammation, intermittent obstruction of the airway and bronchus, and bronchi-

al hyperresponsiveness. The secretions of the airways and mucus result in airflow obstruction and bronchial reactions. Asthma has varying degrees of mononuclear cell and eosinophil infiltration, high mucus secretion, epithelial exfoliation, smooth muscle hyperplasia, and airway remodeling (6 , 7).

Asthma is usually diagnosed by observing variable and intermittent airflow obstruction but is usually confirmed by objective measures of lung function. Pulmonary function is examined by spirometry; it confirms airflow obstruction by displaying a decrease in FEV1/FVC and PEF. The reversible airflow obstruction may be observed by an increase in FEV1 (>12% and >200 mL) from baseline after inhalation of short-acting β2-agonist, or in some patients following oral glucocorticoid administration (30-40 mg of prednisone or prednisolone per day) for 2-4 weeks (5).

Various factors that lead to airway inflammation include adhesion molecules (such as selectin and integrin). These molecules induce inflammatory changes in the airways. Finally, inflammatory mediators influence the degree of airway smooth muscle contraction. They also cause structural remodeling in the airways (8). The airway obstruction can manifest itself with a variety of changes, including bronchoconstriction, laryngeal edema, chronic mucoid plaque formation, and airway remodeling (8). The airway obstruction increases airway resistance and decreases peak expiratory flow. These changes lead to reduced expiration and consequently emphysema. Post-stretch peak leads to airway opening (9).

Factors involved in asthma or airway hyper-responsiveness include environmental allergens (such as domestic mites, animal allergens especially cats and dogs, fungal and cockroach allergens), upper airway viral infections, exercise, gastroesophageal reflux disease (GERD), chronic rhinitis or sinusitis, hypersensitivity to aspirin or NSAIDs, use of beta-blockers to treat obesity, environmental pollutants, smoking, stimulants (such as home sprays and paints), low and high molecular weight compounds (insecticides, plants, bleach, adhesives, di-isocyanate, anhydride, sawdust in association with occupational asthma), emotional and stress factors, and birth factors (prematurity, high maternal age, maternal smoking, maternal exposure to smoke, inadequate breastfeeding) (10).

Asthma has a profound impact on patients' lives and performance, affecting group activity and social functioning, psychological functioning, and even economic progress (11). Various studies have shown that asthma is currently a common chronic illness and one of the most serious health-threatening risk factors. When asthma occurs in a person, it causes changes in different aspects of normal or physiological function (12). The prevalence of asthma in Iran is 5 to 7%. By mentioning the impacts of asthma on health as well as the quality of life of patients, since no such research has been conducted in Yazd, there is a need to obtain information about asthma control by patients.

MATERIALS AND METHODS
Study Population
The current descriptive cross-sectional study was conducted on the population of asthmatic patients referred to the Lung clinic in Yazd, Iran, during the period November 22, 2018, until September 21, 2019. Based on the maximum facilities available, the sample size in this study was estimated at 200 patients with asthma who were selected randomly from the asthmatic patient population referred. The inclusion criteria were all patients over the age of 18 years who were diagnosed with asthma by a specialist physician one year before participating in the study. Exclusion criteria were history of any mental disorder, other chronic pulmonary diseases, pregnancy, and asthma attack at four weeks prior to the study. After obtaining consent, the questionnaire was completely filled while interviewing each patient. The questionnaire included age, gender, body mass index (BMI), educational level, occupation, and smoking status. A history taking of the patient's asthma status in the last six months and the history of the patient's asthma by year were also questioned.

Asthma Control Test Questionnaire
The asthma control test (ACT) questionnaire for patients was filled by the physician. An asthma control assessment questionnaire was compiled for the patients based on the GINA 2016 guidelines. The assessment of patient's quality of life was assessed by asking eight questions. Morisky Medication Adherence Scale (MMAS) was also completed for the patients.

Statistical Analysis
After obtaining the sample size, the collected data were inserted into the SPSS version 17 software. Required tables and indicators were prepared. Data were analyzed by Fisher's exact test, paired t-test, chi-square, and ANOVA.

Ethical Considerations
After obtaining the sample size, the collected data were inserte

Statistical Analysis
Verbal consent was taken from patients to participate in the study. Due to the descriptive design of the study, no special ethical consideration was needed.

RESULTS
Demographic Results of the Study Population
During the ten-month period of data collection, 200 people were studied. In terms of gender distribution, 76 males (38%) and 124 females (62%) participated in this study. In addition, 100% of patients had insurance coverage. 117 patients (58.5%) used to do exercise regularly and 83 patients (41.5%) did not exercise. To study the age groups of the present study, the participants were divided into six groups (Table 1).

According to BMI, five groups were formed with the lowest and the highest frequencies of BMI were in the group of 35-50 kg/m2 and in the group of 20.99-24 kg/m2.

As shown in Table 1, the frequency distribution of smoking in the samples was calculated, so that 175 (87.5%) were

non-smokers, 15 (7.5%) were smokers and 10 (5%) had quit smoking for six months prior to entering the project.

The least frequent educational level was related to master's degree and Ph.D. while the highest frequency of study group was of the educational level of high school.

Table 3 contains the distribution of educational level; 25 (12.5%) were uneducated, 64 (32%) at the educational level of primary school, 73 (17%) at the educational level of high school, 34 (36.5%) at the educational level of associate degree and bachelor's degree, and 4 (2%) at the educational level of master's degree and Ph.D.

As shown in Table 2, the frequency distribution of history of asthma showed 176 (88%) group 1-10 years, 19 (9.5%) in the group 11-20 years, and 5 (2.5%) in the group 21-30 years. The mean history of asthma was 5.23 ± 5.78 years with a range of 1-30 years.

According to Table 3, the frequency distribution of patients' asthma status six months before the study was: 110 patients (55%) less than once a week, 39 patients (19.5%) less than once a week but not daily, and 51 patients (25.5%) with daily symptoms of asthma, 180 patients (90%) with mild asthma exacerbations, 6 patients (2%) with exacerbations affecting the activity and sleep, and 14 patients (7%) with frequent asthma exacerbations. The status of nocturnal symptoms of asthma was: 93 patients (46.5%) less than twice a month, 29 patients (14.5%) more than twice a month, 38 patients (19%) more than once a week, and 40 patients (20%) with frequent nocturnal symptoms.

In the spirometry, none of patients had PEF<20%, 1 (0.5%) had PEF=20-30%, 1 (0.5%) had PEF>30%, 10 (5%) had PEF<60%, 35 (17.5%) had PEF=60-80%, and 153 (76.5%) had PEF>80%.

Status of Asthma Control

As shown in Table 4, 17 (8.5%) had uncontrolled asthma in the past month, 59 (29.5%) had poor control, 47 (23.5%) had partial control, 68 (34%) had complete control and 9 (4.5%) considered their asthma controlled.

According to the ACT, the patients received a score of 4-20; afterward, they were divided into three groups of uncontrolled, partial control, and complete control. As shown in Table 4 and according to ACT data, the asthma was uncontrolled in 28 (14%), partially controlled in 144 (72%), and completely controlled in 28 (14%).

The asthma control associated three groups (uncontrolled, partial control and complete control modes) were measured by the variables of age (P=0.232), gender (P=0.714), BMI (P=0.437), educational level (P=0.225), smoking (P=0.252), smoking in the last six months (P=0.052) and non-smoking (P=0.083). The association of any of the variables with asthma control was not significant (P> 0.05).

After data analysis, the asthma control questions results were summed according to the GINA 2016 guidelines and rated from 0 to 5. Accordingly, asthma patients were divided into three groups of uncontrolled, partial control, and complete control. Based on the GINA 2016 guidelines (Table 4), the asthma was uncontrolled in 62 (31%), partially controlled in 105 (52.5%) and completely controlled in 33 (16.5%).

Analysis of results by statistical tests showed that the asthma control based on physician's opinion and according to the GINA 2016 guidelines with age (P=0.037) and smoking cessation six months before the study (P=0.029) were significant, implying that the asthma control varies by age and by people who quit smoking up to six months before the study. However, the above association with gender (P=0.364), BMI (P=0.055), educational level (P=0.148), smoking (P=0.394) and nonsmoking (P=0.502) was not significant.

The Quality of Life in the Studied Samples

Based on data, the scores of quality of life were from 6 to 42 and then divided into three categories of good, moderate, and poor. The results showed a good quality of life for 2 (1%), moderate quality of life for 197 (98.5%), and poor quality of life for 1 (0.5%).

Thereafter, the association of quality of life in the studied asthmatic patients was measured with the same variables. There was no association between the quality of life and age (P=0.122), BMI (P=0.905), gender (P=0.083), educational level (P=0.314), smoking cessation six months prior to the study (P=0.915), and non-smoking (P=0.804). However, the above association with smoking was significant (P=0.002), meaning that the quality of life in smokers was different.

Frequency of Medication Adherence Based on MMAS Questionnaire

The MMAS questionnaire was completely filled for patients regarding medication adherence. Then, the results were scored from 0 to 4, suchlike poor=0, moderate=1-3, and good=4.

Data analysis of the MMAS questionnaire showed good medication adherence in 30 (15%), moderate medication adherence in 166 (83%), and poor medication adherence in 4 (2%).

Association of medication adherence with demographic variables

The association of medication adherence was measured with the same variables. The association of medication adherence with any of the variables of age (P=0.478), gender (P=0.508), BMI (P=0.816), educational level (P=0.162), smoking (0.827), smoking cessation in the last six months (P=0.855), and non-smoking (P=0.661) had no significant difference.

DISCUSSION

According to ACT data in the current study, asthma was uncontrolled in 28 (14%), partially controlled in 144 (72%), and completely controlled in 28 (14%). The asthma control based on physician's opinion and according to the GINA 2016 guidelines with age (P=0.037) and smoking cessation six months before the study (P=0.029) were significant, which is in line with a study of Anissa Afrite et al (2006) in France who reported only 29% of patients with complete control, 46% with partial control and 15% with uncontrolled asthma. According to our results, based on the ACT and

GINA 2016 guidelines, less than 50% of patients had complete control of asthma (13).

According to the GINA guidelines, Vanessa Waibel et al. (2012) found that 66% of patients had partial control of asthma, 18% were uncontrolled and 16% had complete control of asthma, inconsistent with our results (15).

David Price et al. (1) evaluated that 45% of patients had uncontrolled asthma and 80% had the controlled asthma. Our study of uncontrolled asthma is in line with this study and was consistent with patients' perceptions of their asthma control; 77% of our patients reported well-controlled asthma (17). Laura S. Gold et al. (1) in Latin America found that 3% of patients in Venezuela had complete control of asthma, 9.3% in Brazil, and 9% in Mexico had complete control of asthma. In Brazil and Puerto Rico, poor control of asthma was associated with older age. Good control of asthma in all countries has been associated with academic and educational level. The current study conforms with that of Laura S. Gold on uncontrolled asthma and association with age, but no similar results were obtained regarding association with educational level (18).

Hoy H. M et al (1) concluded that uncontrolled and symptomatic asthma is common in the United States, 46-78% of asthma cases in the US are uncontrolled, and this uncontrolled asthma had a detrimental effect on patients' quality of life, as observed in the present study (19). Over 50% of our patients had partial control and uncontrolled asthma. In a study by Nathan RA et al. (2015) on 10302 asthma patients, 67% of patients reported controlled asthma, consistent with the results of the present study (77% of patients reported controlled asthma) (20).

The quality of life was scored from 6 to 42 based on data. Then, the quality of life was divided into three categories of good, moderate, and poor. The results showed a good quality of life for 2 (1%), moderate quality of life for 197 (98.5%), and poor quality of life for 1 (0.5%). Then, the association of quality of life was measured with age, BMI, gender, educational level, and smoking status, which was significant only with smoking (P=0.002), connoting that the quality of life was different in smokers.

In a study by José Maria Olaguibel et al. (2012), the GINA guideline showed 13.6% of patients with complete control of asthma, 34.2% with partial control, and 52.3% with uncontrolled asthma. This study was consistent with the present study regarding the complete control of asthma but inconsistent in partial control and uncontrolled asthma (14).

Mary Kampe et al. (2013) in Sweden found that 35% of patients had uncontrolled asthma in primary care and 45% of patients had uncontrolled asthma in secondary care. The risk factor of poor control of asthma had an association with smoking, low educational level, and female gender. The results of the present study were consistent with this study regarding uncontrolled asthma in primary care but inconsistent with the association of gender and educational level with asthma control (16).

Good medication adherence was seen in 300 (15%), moderate medication adherence in 166 (83%), and poor medication adherence in 4 (2%). The association of medication adherence was assessed by age, gender, educational level, BMI, and smoking status. None of them showed a significant association.

CONCLUSION

According to the outcomes of this current study, less than 50% of patients had complete control of asthma, and more than 50% of patients had partial control of asthma as well as uncontrolled asthma. Asthma control had an association with age as well as with smoking cessation six months prior to the study.

AUTHOR CONTRIBUTION

All authors contributed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICAL STANDARDS

Verbal consent was taken from patients to participate in the study. Due to the descriptive design of the study, no special ethical consideration was needed.

Table 1- Frequency distribution of age in studied samples

Variables	Frequency	Percentage
Age (year)		
15-29	28	14
30-39	44	22
40-49	51	25.5
50-59	36	18
60-69	31	15.5
70-79	10	5
Total	200	100
Body mass index (kg/m^2)		
15-19.99	14	7
20-24.99	55	27.5
25-29.99	82	41
30-34.99	39	19.5
35-50	10	5
Total	200	100
Smoking		
Never	175	87.5
Up to last six months	10	5
Yes	15	7.5
Total	200	100
Educational level		
Uneducated	25	12.5
Primary school	64	32
High school	73	36.5
associate degree and bachelor's degree	34	17
master's degree and PhD	4	2
Total	200	100

Table 2- Frequency distribution of history of asthma (year) in the study population

history of asthma	Frequency	Percentage
1-10	176	88
11-20	19	9.5
1-30	5	2.5
Total	200	100

Table 3- Frequency distribution of patients' asthma status in the six months before the study in the study population

Symptoms	Features of symptoms	Frequency	Percentage
Less than twice a month daily	Less than once a week	110	55
	More than once a week and less than once a month	39	19.5
	Daily	51	25.5
	Total	200	100
Nocturnal symptoms	Less than twice a month	93	46.5
	More than twice a month	29	14.5
	More than once a week	38	19
	Frequent nocturnal symptoms	40	20
	Total	200	100
Exacerbations	Mild	180	90
	Influencing patients' activities and sleep	6	3
	Frequent exacerbations	14	7
	Total	200	100
Peak expiratory flow	%20<	0	0
	%30-20	1	0.5
	%30>	1	0.5
	%60<	10	5
	%80-60	35	17.5
	%80>	153	76.5
	Total	200	100

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Variables	Frequency	Percentage
Age (year)		
15-29	28	14
30-39	44	22
40-49	51	25.5
50-59	36	18
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15-19.99	14	7
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25-29.99	82	41
30-34.99	39	19.5
35-50	10	5
Total	200	100
Smoking		
Never	175	87.5
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Educational level		
Uneducated	25	12.5
Primary school	64	32
High school	73	36.5
associate degree and bachelor's degree	34	17
master's degree and PhD	4	2
Total	200	100

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