

Gender Differences on Airway Obstruction in Smokers

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Abstract

Objectives: Published data on gender differences in the effect of smoking on pulmonary function have been controversial. The study was designed to investigate the gender differences in effects of smoking on pulmonary function.

Methods: Female smokers were chosen among individuals older than 40 yrs, living in home for the aged. Male smokers were chosen from among office workers older than 40 yrs in MCI (machine chemical industry). Total 215 female smokers and 283 male smokers included the study.

The individuals were interrogated with a questionnaire concerning respiratory symptoms, smoking status and other characteristics. Chronic airway obstruction was defined by $FEV_1/FVC < 70\%$.

Results: The prevalence of chronic bronchitis in male smokers was similar to those of female smokers. The prevalence of airflow obstruction was higher in male smokers than female smokers [11.0% vs 3.7%, OR=3.1 (95%CI 1.4 to 7.0), $p=0.003$, respectively].

The man smokers compared to women smokers had lower values of the ratio forced expiratory volume in 1 second to forced vital capacity (FEV_1/FVC) (81.1 ± 8.3 vs 86.9 ± 7.9 , $p=0.0001$, respectively) and lower the dyspnea score. FEV_1/FVC was an important predictor for magnitude of dyspnea, after adjusting for confounding factors in all subjects in regression analysis.

Conclusions: Male smokers have more severe airway obstruction and lower perception of dyspnea than female smokers with similar age and smoking burden. The males are particularly prone than females to the negative effects of smoking. Individuals' perceptions of airway obstruction and response to cigarette smoke vary depending on gender.

Keywords: Smoking; Male; Female; Chronic airway obstruction; Perception of dyspnea; Pulmonary functions

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality and represents a substantial economic and social burden throughout the world [1,2]. Cigarette smoking is the most important risk factor for the development of COPD [3,4]. The prevalence of smoking is slowly decreasing in the industrialised world and rising in developing countries, especially in Asia and Africa [5]. Current data show that women now suffer from COPD at least as commonly as men. They seem to be more predisposed to suffer the adverse respiratory consequences of tobacco smoking with the development of COPD at an earlier age and with a greater degree of lung function impairment [6-9]. Indoor air pollution from combustion of biomass/traditional fuels and coal, previous tuberculous infection, outdoor air pollution and childhood respiratory infections are other important risk factors for COPD in developing countries. Women with COPD also seem to be underdiagnosed by physicians and may have different responses to medical treatment, smoking cessation interventions, and pulmonary rehabilitation programs [10].

Previous studies have indicated an increased female susceptibility to smoking-related decline in lung function [11]. On the other hand, other studies have not confirmed that gender effect on pulmonary function in smoking [12].

Thus, published data on gender differences in the effect of smoking on pulmonary function have been controversial. This analysis of a cohort of male and female smokers was designed to test for differences between men and women in chronic airway obstruction.

In all workers, a detailed occupational history, as well as questions about their smoking habits were recorded.

Methods

Study population

Smoker females were chosen among individuals older than 40 yrs, living in home for the aged. In all workers, a detailed occupational history, as well as questions about their smoking habits, were recorded. Smoker males consisted of office workers not exposed to chemicals, dust, working at MCI. For each smoker females, we selected a smoker males counterpart (randomly selected from those with same age and

cigarette pack years) from the 692 eligible smoker individuals in the baseline data. Smokers consisted of ex-smokers and current smokers.

The presence of respiratory diseases bronchiectasis, interstitial lung disease and uncontrolled comorbidities such as malignancy, severe hepatic failure, hearth failure were accepted as exclusion criteria. Total 215 female smokers and 283 male smokers included the study. All subjects gave written informed consent to taking. The study was approved by the local ethics committee.

Procedures

The survey team consisted of the nine chest physicians. All subjects were interrogated with a questionnaire concerning respiratory symptoms, somatic diseases, socioeconomic status, smoking status, and other characteristics [13]. Dyspnea was assessed using the MMRC dyspnea scale. Psychological disorders was investigated by using hospital anxiety and depression (HAD) scale. After their height was measured, spirometry (portable dry rolling spirometer; MIR spirometry ITALY) was performed, according to the recommendations of the American Thoracic Society, and the results were calculated on the basis of predicted values [14,15].

MMRC scale

The severity of dyspnea, defined as ‘the unpleasant sensation of labored or difficult breathing’, was rated according to the modified MMRC scale [16]. Verbal descriptors of MMRC scale start from 0 (not troubled by dyspnea) to a maximum value of 5 (dyspnea for minimal effort). The MMRC score was administered by a physician.

Assessment of psychological status

The patients were asked to fill in the self-reported HAD (hospital anxiety and depression scale) questionnaire. The questionnaire consisted of 14 questions in which the overall severity of anxiety and depression was rated on four-point scale (0 to 3). Seven questions were related to anxiety and seven to depression [17].

Chronic bronchitis, defined as cough or phlegm on most days for more than 3 month per year for at least 2 consecutive years. Chronic airway obstruction was defined as a FEV₁/FVC (forced expiratory volume in 1 s/ the forced vital capacity) <0.70.

Statistical Analysis

The chi-square test was used for testing differences in the prevalence of respiratory symptoms between the two groups. Crude odds ratios (ORs) were calculated by using the Mantel-Haenszel method. For comparisons of continuous variables a t-test was performed.

Results of ventilatory capacity tests were analyzed by applying a multiple regression analysis with age, smoking (cigarette pack-year), income and education as predictors, and FEV₁/ FVC and dyspnea as criteria variables. Logistic regression analysis was examined the relation between presence of chronic airway disease (presence of FEV₁/FVC<70%), as the dependent variables, and age, gender, smoking (cigarette pack-year), income, education, depression and anxiety scores, as predictor variables. The mean values were given as ± Standard deviation. A p-value <0.05 was taken as significant.

Results

Total 215 female smokers (43.1%) and 283 male smokers (56.8%) included the study. 178 patients (82.8%) was current smokers among female smokers. 189 patients (66.8%) was current smokers among male smokers. The demographic characteristics of the subjects in the population are shown in Table 1.

	Smokers females n: 215	Smokers males n: 283	P value*
Age	55.6 ± 10.6	56.2 ± 8.2	0.1
Education	14.4	22.7	0.001
None	28.7	28.6	NS
Primary high school	32.4	27.9	NS
Secondary high school	24.5	20.8	0.0001
Monthly income (%) <\$ 200	50.5	51.9	0.04
Pred FEV1	88.5 ± 18.8	89.8 ± 11.9	0.3
FEV1/FVC	86.9 ± 7.9	81.1 ± 8.3	0.0001
FVC%	86.0 ± 17.1	85.7 ± 10.5	0.5
MMF%	77.6 ± 27.7	72.7 ± 28.2	0.07
Dyspnea score	1.9 ± 1.4	0.8 ± 1.0	0.001
Chronic bronchitis, (%)	69/215 (32.0)	95/283 (33.6)	0.7
Smoking pack/year	22.4 ± 16.6	22.3 ± 11.6	0.9
Anxiety score	8.4 ± 4.2	6.5 ± 3.4	0.001
Depression score	8.6 ± 4.9	6.7 ± 3.3	0.002

Table 1: Characteristics of all subjects.
*when compared smokers females and males

The smokers men compared to smokers women had lower values of the ratio forced expiratory volume in 1 second to forced vital capacity (FEV₁/FVC) (81.1 ± 8.3 vs 86.9 ± 7.9, p=0.0001, respectively) and lower the dyspnea score (0.8 ± 1.0 vs 1.9 ± 1.4, p=0.0001 respectively).

The prevalence of chronic bronchitis did not differ between smokers males and smokers females. Both depression (8.6 ± 4.9 vs 6.7 ± 3.3, p=0.002 respectively) and anxiety (8.4 ± 4.2 vs 6.5 ± 3.4, p=0.001 respectively) scores were higher in smokers female than in smokers male. The smokers men compared to smokers women had lower values of dyspnea scores (Table 1).

The prevalence of airflow obstruction was higher in smokers males than smokers females (11.0% vs 3.7%, OR=3.1 (95%CI 1.4 to 7.0), p=0.003, respectively) (Table 2).

	Female n: 216%	Male n: 59%	p-value	OR (CI)
Chronic airway obstruction (FEV1/FVC < 70%)	3.7	11.0	0.003	3.1 (1.4 to 7.0)

Table 2: Prevalence of chronic airway diseases in all subjects.

Linear regression analysis showed that smoking and male sex were independent risk factors for chronic airway obstruction, after adjusting for confounding factors in all subjects (Table 3).

	FEV ₁ /FVC	
	Beta	p-value
Age	0.04	0.1
Gender (male)	-0.32	0.0001
Smoking pack/year	-0.21	0.0001
Income	-0.01	0.6
Education	0.01	0.6

Table 3: Predictors of chronic airway obstruction in all subjects.

FEV₁/FVC was an important predictor for magnitude of dyspnea, after adjusting for confounding factors in all subjects in regression analysis (Table 4).

	Beta	p-value	r ²
Age	0.07	0.07	25%
Gender (male)	-0.34	0.0001	
Smoking pack/year	0.03	0.4	
Income	0.08	0.04	
Education	-0.01	0.7	
FEV ₁ /FVC	0.27	0.0001	
Anxiety	0.06	0.1	

Table 4: Perception of dyspnea in all subjects.

Logistic regression analysis showed that male sex were independent risk factors for presence of chronic airway obstruction (FEV₁/FVC<70%) airway after adjusting for confounding factors in all subjects (Tables 5 and 6).

	P values	OR
Age	0.01	1.05 (1.01-1.10)
Gender (male)	0.01	5.8 (1.3-25.2)
Smoking pack/year	0.06	1.02 (0.9-1.05)
Income	0.2	1.5 (0.7-3.3)
Education	0.6	0.9 (0.6-1.39)
Depression	0.1	1.5 (0.9-1.1)

Table 5: The Predictors of Presence of Airway Obstruction (FEV₁/FVC<70%).

	P values	OR
Age	0.01	1.05 (1.01-1.10)
Gender (male)	0.03	4.6 (1.08-1.06)

Smoking pack/year	0.059	1.0 (0.9-1.05)
Income	0.2	1.6 (0.7-3.4)
Education	0.6	0.9 (0.6-1.39)
Anxiety	0.4	0.9 (0.8-1.06)

Table 6: The Predictors of Airway Obstruction (FEV₁/FVC<70%).

Discussion

Male smokers have more severe chronic airway obstruction than female smokers, adjusted for smoking burden and age. Although similar the prevalence of chronic bronchitis, the chronic airway obstruction is shown to be more common in male smokers than female smokers. The significant association among chronic airway obstruction and cigarette smoking and gender in linear model also provide additional evidence for relation. Accordingly, airways of men are more susceptible to smoking effects than women. Furthermore, gender difference in response to cigarette smoke of airways in individuals appeared to play an important role. Individuals' response to cigarette smoke varies depending on gender. In addition, adverse effect on pulmonary function of cigarette smoking is more evident in males than females. Published data on gender differences in the effect of smoking on pulmonary function have been controversial. A study on pulmonary functions in young smokers indicated that men developed chronic obstruction pulmonary disease more frequently than do women even when adjustments for smoking are made. According to the authors, these results may reflect distinct pathophysiologic response of the 2 sexes to agents such as cigarettes [18]. The study by Xu et al. suggested that adverse smoking effects on pulmonary function were greater in women than in men, by indicating female cigarette smokers had lower values than their male counterparts [19].

A study found that for a given age and level of airflow obstruction, women with COPD had higher BOD scores due to more pronounced dyspnea and lower BMI [20]. In Study by Camp et al. women had a similar pulmonary function with men but fewer pack-years of cigarette smoking. In addition, male smokers have more emphysema than female smokers [21]. Study by de Torres et al. indicated that, at similar chronic obstructive pulmonary disease severity by BODE index and forced expiratory volume in one second, females had significantly better survival than males [22]. In contrast, the paper by Sorheim et al indicated that women are more susceptible to smoking effects than men. Female gender was associated with lung function reduction and more severe disease in subjects with COPD with early onset of disease or low smoking exposure [23]. The reasons for the discrepancy remains uncertain and requires further longitudinal studies.

Another important finding of this study also was that magnitude of dyspnea in men with the more severe airway obstruction was lower than in women. It may considered that females are more likely than males to exaggerate symptoms. Females reported more symptoms compared with males with more severe airway obstruction. In the study by de Roche et al., dyspnea was also more intense in women matched with men on FEV₁% predicted, age [20]. According to this information, gender difference in the perception of airway obstruction of individuals occurs to play an important role.

Furthermore this study found that dyspnea independently associated with psychological distress such as anxiety among both sex.

Accordingly, intensity of dyspnea is also determined by psychological factors.

The study have some limitations. The major criticism was that our study did not take into account narghile smoke and also passive smoke. However, narghile smoke and passive smoke should not be neglected. We have not different perspectives on this issue. Narghile smoke and passive smoke is important for development of chronic airway obstruction. Mohammad et al showed that exposure to passive smoking of either cigarettes or narghiles resulted in association with airway obstruction, defined as forced expiratory volume in 1 second (FEV₁)/forced vital capacity (FVC) <70% [24].

Our study demonstrated important sex differences in the severity of chronic airway obstruction in a population of male and female smokers. Male smokers have more severe airway obstruction and lower perception of dyspnea than female smokers. The males are particularly prone than females to the negative effects of smoking. Individuals' perceptions of airway obstruction and response to cigarette smoke vary depending on gender. More use of spirometry, an objective measure, may improve early diagnosis and management of chronic airway obstruction in the population settings.

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