ORIGINAL PAPERS

Prevalence of Chronic Obstructive Pulmonary Disease and Risk Factors in Smokers and Ex-Smokers

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OBJECTIVE: To estimate the prevalence of chronic obstructive pulmonary disease (COPD) in smokers and ex-smokers over 40 years of age and describe the associated risk factors.

MATERIAL AND METHODS: A cross-sectional descriptive study at primary care level in which 444 current or ex-smokers 40 years of age or older were enrolled. Spirometry was performed with all subjects. If the ratio of forced expiratory volume in 1 second to forced vital capacity (FEV_1/FVC) was less than 70%, a bronchodilator test was performed and spirometry was repeated after 2 inhalations of terbutaline (500 µg/dose). If the FEV_1/FVC ratio continued to be less than 70% and FEV_1 less than 80% of predicted, COPD was diagnosed. Age, sex, smoking, age smoking began, index of smoking history (packs per day × years smoking) and attempts to quit smoking were also recorded.

RESULTS: The patients' mean age was 53.5 years and 65.8% were men. At the time of the study, 248 subjects (55.9%) were current smokers. The median age smoking began was 16.5 years and the median pack-years index was 26.7. At least 1 attempt to quit had been made by 72.1% of the patients. COPD was diagnosed in 70 subjects (24 with the diagnosis previously established), representing a prevalence of 16.4% (95% confidence interval, 12.9-19.9). COPD was serious in 10%. A multifactorial analysis indicated that age and smoking history in pack-years were significantly associated with COPD.

CONCLUSIONS: The prevalence of COPD in our study is slightly higher than in other studies, although selection bias may have affected our results given that we were unable to contact 11.9% of the population sample. Almost two thirds of cases had not been previously diagnosed. Two major risk factors are age and cumulative tobacco consumption.

Key words: *Chronic obstructive pulmonary disease (COPD). Prevalence. Risk factors. Tobacco. Primary care.*

Prevalencia y factores de riesgo de EPOC en fumadores y ex fumadores

OBJETIVO: Estimar la prevalencia de enfermedad pulmonar obstructiva crónica (EPOC) en fumadores y ex fumadores mayores de 40 años y describir los factores asociados.

MATERIAL Y MÉTODOS: Se realizó un estudio descriptivo transversal en el ámbito de la atención primaria. En él se incluyo a 444 personas de 40 años de edad o mayores que fumaban o habían fumado. A todos se les realizó una espirometría. Si la relación volumen espiratorio forzado en el primer segundo/porcentaje de la capacidad vital forzada era menor del 70%, se realizaba una prueba de broncodilatación y se repetía la espirometría a los 15-20 min tras dos inhalaciones de terbutalina (500 µg/dosis). Si la relación volumen espiratorio forzado en el primer segundo/porcentaje de la capacidad vital forzada seguía siendo inferior al 70% y el volumen espiratorio forzado en el primer segundo menor del 80% del teórico, se diagnosticaba EPOC. También se recogieron edad, sexo, consumo de tabaco, edad de inicio, índice tabáquico (paquetes/día × años de consumo) e intentos de abandono.

RESULTADOS: La edad media de los pacientes era de 53,5 años, y un 65,8% eran varones. En el momento del realizar el estudio fumaban 248 sujetos (55,9%). La mediana de inicio del consumo resultó de 16,5 años, y la del índice tabáquico fue de 26,7. El 72,1% había realizado al menos un intento de abandono. Se diagnosticó de EPOC a 70 personas (24 ya conocidas), lo que supone una prevalencia del 16,4% (intervalo de confianza del 95%, 12,9-19,9). Un 10% eran casos graves. Tras el análisis multifactorial resultaron significativamente asociadas a EPOC la edad y el índice tabáquico.

CONCLUSIONES: La prevalencia de EPOC hallada es ligeramente superior a la de otros estudios, si bien puede existir un sesgo en los resultados obtenidos al no haber podido establecer contacto con el 11,9% de la población objeto del estudio. Casi dos tercios de los casos eran desconocidos. Son claros factores de riesgo la edad y el consumo acumulado de tabaco.

Palabras clave: *Enfermedad pulmonar obstructiva crónica (EPOC). Prevalencia. Factores de riesgo. Tabaco. Atención primaria.*

Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation which is usually progressive, only partially reversible, and associated with an abnormal inflammatory response of the lungs to

noxious particles, mainly from cigarette smoke. In order to establish a COPD diagnosis, spirometry must detect a forced expiratory volume in the first second (FEV_1) after bronchodilation less than 80% of predicted, with a ratio of FEV_1 to forced vital capacity (FVC) less than 70%.[1]

Both the prevalence and morbimortality of COPD are high,[2] such that the disease represents a real public health problem and a major burden on health-care resources.[3-5] The epidemiological analysis of COPD is difficult owing to the problems of defining and diagnosing the disease. This, coupled with the fact that many patients are not diagnosed until clinical signs are present and the disease is moderately advanced means that the information about morbidity may be underestimated.[1] Problems such as these reinforce the need to carry out studies that would determine the prevalence and true impact of COPD in Spain—such as the IBERPOC study,[6] which detected a prevalence of 9.1% in the population between 40 and 69 years of age and a high percentage of undiagnosed cases and inappropriate treatments in known cases.

The natural history of COPD is closely bound to smoking and some authors question the diagnosis in cases where subjects do not have a significant smoking history.[7] At present, 35.7% of Spaniards older than 16 years of age are smokers.[8]

The aim of our study was to detect the prevalence of COPD in the target population for current or ex-smokers 40 years of age or older and, secondarily, to identify the characteristics of tobacco consumption and its possible relationship to the disease, together with other factors such as age or sex, all of which were analysed from the perspective of their implications for primary care.

Materials and Methods

A cross-sectional descriptive study was conducted in the city of Toledo, Spain between October 2001 and October 2002.

The sample population formed part of the 1003-subject target population of current or ex-smokers (no smoking in the last 6 months), 40 years of age or older, who visited their assigned primary care physician. The population was young (subjects 65 years of age or older accounted for 7%) with a medium to low socioeconomic status and an unemployment rate similar to the national average. Most were employed in service industries.

Visits by persons older than 40 years of age were used to examine their smoking history and enroll them in the study if they were current or ex-smokers. Patients who did not visit the doctor during this period were contacted by telephone, but if they were not located after three calls, no more calls were made.

Predicting an 85% response rate (853 persons) and that 50% would be current or ex-smokers, the sample size needed was fixed at 425 people. This was a large enough sample to estimate the prevalence of COPD, assuming an expected frequency of 15%, an accuracy of approximately 4%, and a 95% confidence interval (CI).

Data collected concerned age, sex, and smoking history (age smoking began, daily consumption, type of tobacco [blonde, black, or others], and number of years and attempts to quit) of subjects enrolled. Later the index of smoking history in pack-

years was calculated ([number of cigarettes smoked per day × number of years of smoking]/20) and authorization was requested to perform spirometry, noting the reason in case of a patient's refusal.

Spirometry was performed by a single tester (a primary care physician) previously trained at the pneumology department of the referral hospital. The Pony Graphic spirometer (Cosmed, SRL, Rome, Italy) was used. The recommendations of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR)[9] were followed when testing and the spirometer was calibrated at the end of each session with a 3-L syringe. The spirometric reference values used for comparison were those of Roca et al.[10]

If spirometry detected obstruction (FEV_1/FVC <70%), a bronchodilator test was performed and 15 to 20 minutes later, spirometry was repeated after 2 inhalations (500 µg/dose) of terbutaline with the Turbuhaler® system. According to the results of the bronchodilator test, the patient was considered to have COPD when the FEV_1/FVC ratio was less than 70% and the FEV_1 less than 80% of predicted and not to have COPD if the FEV_1/FVC ratio was 70% or more.

The severity of COPD was evaluated in terms of the percentages of FEV_1 as follows[11]: mild (FEV_1 80%-60%), moderate (FEV_1 60%-40%), severe (FEV_1 <40%).

The standard variables were used (mean, median, SD, percentage), with their respective CIs, to describe the results. The statistical analysis was performed with the SPSS 9.0 program, using Pearsons χ^2 test for categorical variables. A Mann-Whitney U test was used to analyze quantitative variables with a nonnormal distribution established by means of a Kolmogorov-Smirnov test. The odds ratio (OR) was used for the epidemiological study. To adjust the OR for factors influencing the prevalence of COPD, a binary logistic regression model was constructed, using the presence of COPD as the dependent variable and the other variables as independent ones. Before accepting the final model, interaction between main variables (age, smoking history, and tobacco type) was ruled out.

Results

Of the 1003 persons 40 years or older assigned to the primary care physician, contact attempts failed with 120 subjects (11.9%). Of the 883 subjects contacted, 439 (49.7%) were never-smokers, 196 (22.2%) ex-smokers, and 248 (28.1%) current smokers at the time of the study. Of the 444 smokers and ex-smokers, 65.8% were men and 34.2% were women. The mean (SD) age was 53.5 (11.4) years. The median age for starting smoking was 16.5 years (interquartile range: 5.0). Of these subjects, 72.1% had tried to quit at least once. The median pack-year rate was 26.7 (interquartile range: 27.8). Blonde tobacco was consumed by 45.9%, black tobacco by 35.6%, and both types by 18.2%.

Spirometry could not be performed in 17 cases (3.8%) due to lack of cooperation of 9 patients, technical difficulties with 3 patients, and other causes for 5 patients. Seventy (16.4%) of the 427 patients for whom data were complete were diagnosed with COPD (95% CI, 12.9-19.9). Fifty-nine cases (84.3% of those with COPD) were in men and 11 (15.7%) were in women. In
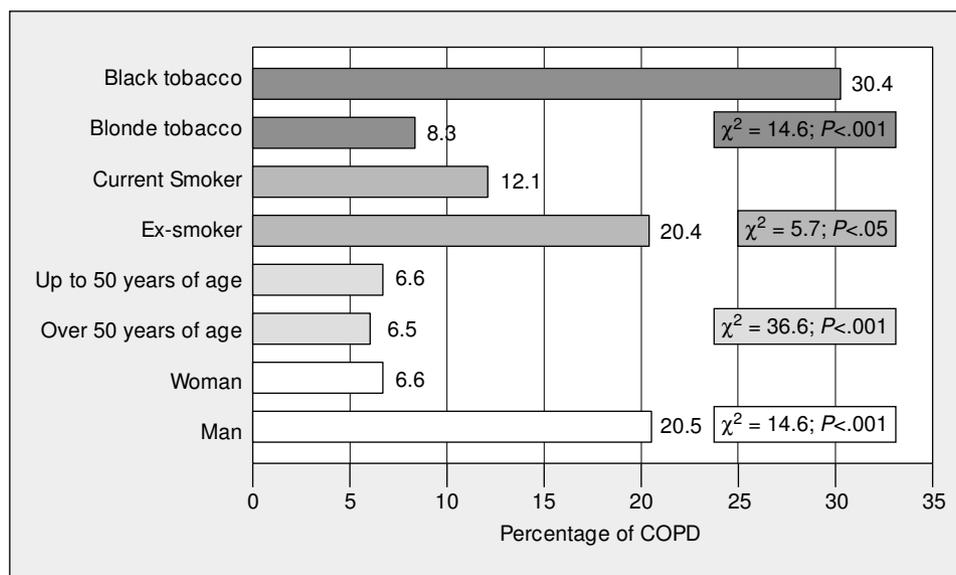
Figure 1. Frequency of chronic obstructive pulmonary disease (COPD) according to sex, age, smoking history, and type of tobacco consumed by smokers or ex-smokers older than 40 years of age.

total, 54.2% were mild cases, 35.7% were moderate, and 10.1% severe. Forty-six (65.7%) of the patients with COPD had not been previously diagnosed.

Figure 1 shows that based on univariate analysis, the frequency of COPD was higher in men ($P<.001$), those 50 years of age or older ($P<.001$), ex-smokers ($P<.05$), and consumers of black tobacco ($P<.001$). There existed a clear relationship between age ($P<.001$) and smoking history ($P<.001$) but age smoking began was not significantly related ($P=.07$) (Figure 2).

After multivariate analysis (Table) the only significant associations were age (adjusted OR=1.07; 95% CI, 1.04-1.10) and smoking history (adjusted OR=1.04; 95% CI, 1.02-1.06). Black tobacco had an adjusted OR of 1.84 (95% CI, 0.87-3.90) without reaching statistical significance

Discussion

Before beginning the discussion of the results we must warn of possible bias. Given the inclusion in the study of previously diagnosed COPD cases, who were all located, together with the impossibility of contacting 12% of the target population or of performing spirometry on all

subjects, the prevalence detected may be slightly overestimated. According to our estimations, based on the incidence found in the population without previous diagnoses, if we had been able to get 100% participation, the prevalence would be of the order of 15.6%, slightly lower than the 16.4% observed.

The prevalence we observed is slightly higher than that of other studies, although comparison is exceptionally difficult because our design was different from those of the other studies. Thus, in the IBERPOC[6] study, which found a 14.6% prevalence in current and ex-smokers among subjects aged 40 to 69 years, the spirometric criteria proposed by the European Respiratory Society (FEV_1/FVC <88% of predicted in men and <89% in women) was used. Brotons et al,[12] who define airflow limitation at FEV_1 lower than 70% of the predicted value combined with a ratio of FEV_1/FVC less than 70%, found a prevalence of 9.1% in the general population 35 to 65 years of age. In a study by Marco et al[13] using the same diagnostic criteria we used, the population was made up of men between 40 and 60 years of age and a prevalence of COPD of 7.5% in men that are current or ex-smokers can be deduced from the data. Nonetheless, we can not compare our data to theirs given

TABLE
Odds Ratios (OR) of the Variables Studied (Dependent Variable: Chronic Obstructive Pulmonary Disease)*

Independent Variables	Crude OR	95% CI	Significance	Ajusted OR[†]	95% CI	Significance
Smoking history, pack-years	1.057	1.04-1.07	$P<.001$	1.046	1.02-1.06	$P<.001$
Age, years	1.104	1.07-1.13	$P<.001$	1.067	1.03-1.10	$P<.001$
Type of tobacco, black/blonde	4.800	2.63-8.75	$P<.001$	1.842	0.86-3.90	$P=.110$
Age smoking began, years	0.948	0.89-1.00	$P<.073$	1.021	0.95-1.09	$P=.527$
Number of attempts to quit	0.969	0.86-1.09	$P<.602$	0.986	0.83-1.16	$P=.874$
Sex, male/female	3.670	1.82-7.40	$P<.001$	1.063	0.42-2.69	$P=.896$
Habit, ex-smoker/current smoker	1.863	1.11-3.12	$P<.05$	1.018	0.47-2.17	$P=.963$

*CI indicates confidence interval.
†Adjustment by means of a binary logistic regression model in which all the independent variables of the table are included.
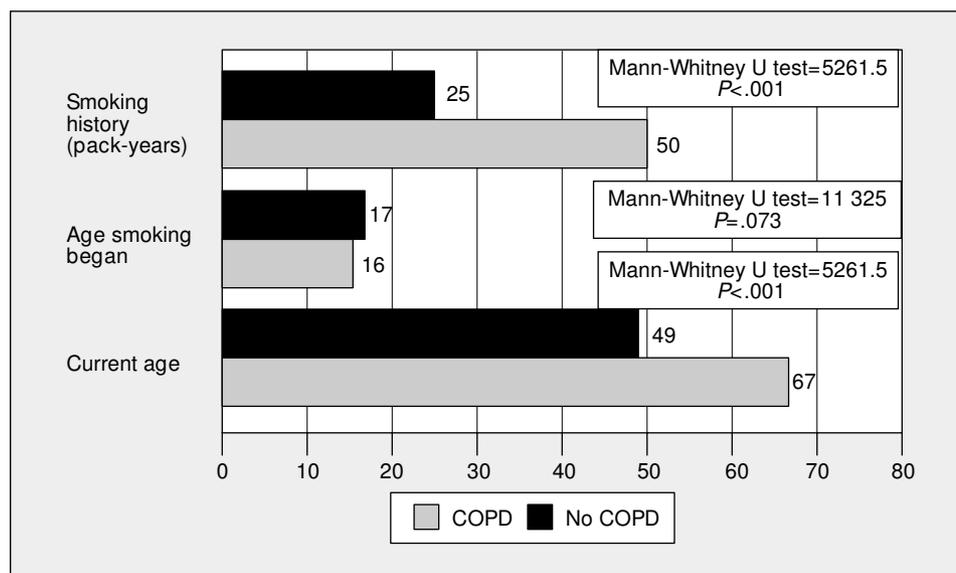
Figure 2. Comparison of median age, smoking history, and age smoking began among patients with and without chronic obstructive pulmonary disease (COPD).

that the target populations were different.

The results regarding the prevalence of COPD according to smoking dependence are similar to those of other studies. Our results show a 12.1% prevalence of COPD in current smokers and 20.4% in ex-smokers. This difference, however, is due to a confounding effect of age, which is greater in the ex-smokers (in fact, on doing the multivariate analysis, the OR was 1.01), and to the fact that 20 of the 24 patients with previously diagnosed COPD had quit smoking, swelling, therefore, the ranks of ex-smokers.

The same pattern holds true with regard to sex. At first sight, the prevalence of COPD in men is almost 4 times greater than in women[6,12,13]; nonetheless, this is due to the existence of confounding factors (age and smoking history). Controlling for these variables by multivariate analysis indicates that being male is not in itself a risk factor for COPD. In any case, in the near future, given the rise in tobacco consumption by women during the decade 1970-1980, we will probably witness a substantial increase in COPD cases in women.[11]

Basically, the variables related to the greatest risk of COPD are age and smoking history.[6,15] Although obvious, we must remind ourselves that any preventive measure taken in relation to COPD must be inevitably linked to the fight against tobacco.

A special mention should be reserved for the type of tobacco consumed. Although the relevance of the consumption of black tobacco was not statistically significant in the final regression model, we believe it might be worth investigating further given that we have been unable to find any mention of it in the literature.

We would like to draw attention to the high number of cases of COPD that are not diagnosed.[7,15] The percentage was 78.2% in the IBERPOC study[6] and 65% in ours. The lower percentage in the present study may be explained by the fact that we studied a population assigned to one

doctor who had been using spirometry as a diagnostic tool for years and who therefore would have had more experience than other professionals who do not use this resource. In any case, in both studies the data reflect a situation that is difficult to accept.

There are 2 possible explanations for the low number of diagnoses of COPD: low use of respiratory tests on the part of the family practitioner[16,17] and the reluctance of smokers to consult for symptoms they consider normal, such as cough or expectoration. Such patients usually seek medical help only when they experience dyspnea (either basal or during the process of acute exacerbation) at a relatively advanced stage of the disease.[1] There can be no doubt, therefore, of the need to establish an early diagnosis of the disease (in the preclinical phase). The most appropriate context for this is primary care and the most efficient diagnostic approach would be to perform spirometry on groups at risk (mainly smokers in the range of 40 to 50 years of age or older) either by screening[18] or fortuitous case finding.[15] It is necessary to ensure that spirometry is performed correctly, that existing standards of quality are met,[19] and that professionals who do it are trained and supervised.[20]

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