Original Research Article

Prevalence of chronic obstructive pulmonary disease among adults in Kashmir (North India): a population based study

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD), represents an important public health challenge that is both preventable and treatable. This study provides population based spirometry data on the burden of COPD in adult population of Kashmir Valley. Objectives of the study were to estimate the prevalence of chronic obstructive pulmonary disease and its associated risk factors in age group 40 years and above among Kashmiri population.
Methods: This study was conducted from April 2012 to December 2014. Multi stage gender stratified cluster sampling was employed to select 30 clusters from two blocks of Kashmir. A total of 504 males and 521 females performed acceptable spirometry after providing information on personal characteristics and relevant risk factors. Participants: Adults aged 40 years and above of Kashmiri ethnicity with no contraindication for spirometry. Variables: Proportion of subjects with FEV1/FVC less than 0.70, percent predicted FEV_1 and FVC. Statistical methods: Descriptive statistics using frequencies, chi square test.
Results: Overall prevalence of COPD at stage I or higher was 15.90%, and was higher in males (19.05) than in females (12.08). The prevalence of Grade 1, 2, 3 and 4 COPD was 8.8%, 5.2%, 1.4% and 0.6% respectively. Chronic obstructive pulmonary disease (COPD) prevalence was associated with increased age and tobacco smoking. COPD prevalence was 2.7%, 22%, 28.2% in non-smokers, ex-smokers and current smokers respectively. 59.5% subjects had a positive history of tobacco exposure.
Conclusions: This study concludes that there is a high prevalence of COPD in Kashmir, high prevalence of COPD is attributed to high incidence of tobacco smoking in the study population.

Keywords: COPD prevalence, Smoking, Spirometry

INTRODUCTION

Chronic obstructive pulmonary disease (COPD), is a common preventable and treatable disease which is characterized by persistent airflow limitation that is usually progressive. It is associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases.[1] COPD affects 210 million people worldwide and is projected to rank third in 2020.[2,3] This increase in mortality will be largely due to the cumulative exposure of the present population to cigarette smoke and the expected aging of the world population.[1]Inhaled noxious particles most important being the tobacco smoke cause an inflammatory response in the lungs, which is exaggerated in some smokers, and leads to the characteristic pathological lesions of COPD.[1] The degree of inflammation, fibrosis, and luminal exudates in small airways is correlated with the reduction

in FEV_1 and FEV_1/FVC ratio, and with the accelerated decline in FEV_1 characteristic of COPD.[4] In the past COPD has been defined symptomatically as chronic bronchitis, anatomically as emphysema or most recently physiologically as airways obstruction.[5] Currently the physiological definition is being most commonly used.[6] There is a growing consensus on the use of spirometry as a criterion, for the diagnosis of chronic obstructive pulmonary disease.[7]

Global Initiative for Chronic Obstructive Lung Disease (GOLD) recommends use of spirometry for the diagnosis and identification of COPD, the presence of post-bronchodilator FEV_1/FVC <0.70 confirms the presence of persistent/irreversible airflow limitation and thus of COPD.[1] Use of fixed FEV_1/FVC ratio does have a disadvantage of over-diagnosis in elderly compared to using cut-off based on lower limit of normal (LLN) values for FEV_1/FVC.[8] However LLN values are highly dependent on choice of valid reference equation.[9]

Objectives

Keeping in view the current burden and expected future trend of COPD in addition to the fact that there is lack of population based spirometry data in Kashmir, this study was conceptualized with the aim of estimating the prevalence of COPD in age group 40 years and above. In addition prevalence of risk factors for COPD were also estimated for the same population.

METHODS

Study design

A field based cross-sectional study in adults aged 40 years and above was conducted from April 2012 to December 2014 in Kashmir valley, Jammu and Kashmir, India.

Sampling method and sample size

Gender stratified multistage cluster sampling technique was used to select subjects for the study. Sample size was calculated by using the formula for prevalence studies using a design effect of two and allowing for non-response rate of 15%. An estimated prevalence of 14.3% for COPD was used for sample size estimation.[10] The sample size was estimated to be 1200.[11,12] In order to achieve the required number of subjects we included 40 clusters and each cluster included 30 subjects.

Selection of study subjects

In the first stage two districts were selected by simple random sampling using lottery method. In the second stage one block from each district was selected randomly by lottery method. A line list of all villages/urban wards in the selected blocks was obtained and 20 clusters were selected from each block by PPS sampling. From each

selected village 15 males and 15 males aged 40 years and above were selected by random selection of households of the village. A total of 1200 were enrolled out of which 1025 subjects could perform acceptable spirometry and were included in final study.

Examination protocol

The examination protocol included a questionnaire covering socio-demographic information, baseline information, information about respiratory symptoms and exposure to risk factors of COPD. Socio-economic status was assessed by modified BG Prasad scale.[13] Overcrowding was defined by standard definition.[14] Height and weight was recorded.

Subjects then underwent spirometry test according to ATS Criteria.[15] A pre-bronchodilator FEV_1/FVC ratio of less than 0.70 was considered as airways obstruction. To confirm irreversible airways obstruction, 200 micrograms of salbutamol were given by an inhaler using a 500 ml spacer and repeat spirometry done after 20min. If the FEV_1/FEV ratio was less than 0.70 after bronchodilator the subject was diagnosed with chronic obstructive pulmonary disease.

Equipment

Spirometry was performed by Helios 401 Spirometer which is a turbine portable spirometer manufactured by Recorders and Medicare systems, Chandigarh.

Lung volumes computed

The lung volumes computed included 1-second and 6-second forced expiratory volumes (FEV_1 and FEV_6) and forced vital capacity. Predicted values were calculated using reference equations for north India.[16]

Interpretation of results

A post-bronchodilator FEV_1/FVC ratio of less than 0.70 was considered as irreversible airways obstruction and used a diagnostic criteria for COPD.

Exclusion criteria

Sick debilitated persons unable to perform spirometry, subjects who had any thoracic, abdominal or eye surgery, myocardial infarction or hospitalization due to cardiovascular problems in last three months, persons undergoing tuberculosis treatment, pregnant women and subjects with heart rate above 120 beats/minute were excluded from the study as per the ATS recommendations.[17,18]

Statistical analysis

The data was entered in Microsoft excel (2007) and analysed using appropriate statistical software.

Frequencies were obtained using descriptive statistics. Tests of proportions (chi-square), unpaired t-test, Mann Whitney Test were used. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 1025 subjects were included in the final sample which comprised of 521 males and 504 females. The prevalence of GOLD Stage 1 or higher COPD in persons aged 40 years and above was estimated to be 15.9%. It was significantly higher in males (19.4%) than females (12.5%).The prevalence of COPD was 28.2% for current smokers, 22% for ex-smokers and 2.7% in non-smokers (Table 1).

Older age, current and/or past smoking and symptoms of chronic bronchitis had a statistically significant relation with presence of COPD. Socio-economic status, type of fuel being used presently and overcrowding at homes did not show any significant relation with COPD (Table 1).

Table 1: Estimated population prevalence of GOLD stage 1 or higher on basis of various factors.

| Characteristics	N	COPD N (%)	OR (95% CI)	P value
Gender				
Male	504	98 (19.4)	1.69 (1.2 – 2.4)	0.002
Female	521	65 (12.5)	1 (reference)	
Age (in years)				
40-49	341	36 (10.6)	1 (reference)	<0.001
50-59	334	45 (13.5)	1.32 (0.9 – 2.1)	
60-69	225	41 (18.2)	1.89 (1.2 – 3.1)	
70+	125	41 (32.8)	4.14 (2.5 – 6.9)	
Smoking status				
Current smoker	287	81 (28.2)	14.4 (7.5 – 27.7)	<0.0001
Ex-Smoker	323	71 (22)	10.3 (5.4 – 20)	
Never-Smoker	415	11 (2.7)	1 (reference)	
Chronic bronchitis				
Present	77	51 (66.2)	14.6 (8.8 – 24.4)	<0.001
Absent	948	112 (11.8)	1 (reference)	
Socio-economic status				
Class I	112	18 (16.1)	1.1 (0.6-1.8)	0.99
Class II	262	41 (15.6)	0.98 (0.6-1.6)	
Class III	371	59 (15.9)	1 (0.6–1.5)	
Class IV & V	278	44 (15.8)	1 (reference)	
Fuel using presently				
Kerosene/LPG	998	159 (15.9)	1 (reference)	0.87
Biomass	27	4 (14.8)	0.9 (0.3-2.7)	
Overcrowding				
Absent	497	75 (15.1)	1 (reference)	0.49
Present	528	88 (16.7)	1.1 (0.8-1.6)	
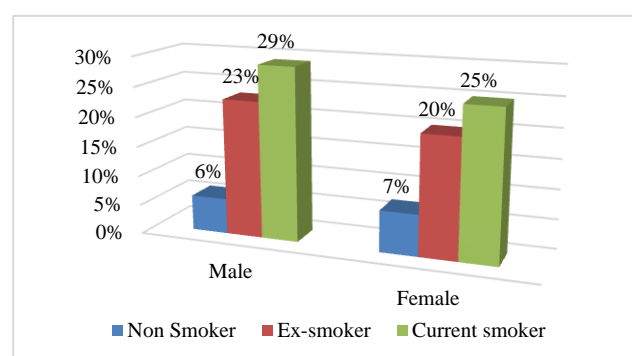
Figure 1: COPD prevalence stratified by gender and smoking history.

History of current and past smoking was more common in men. Of the study sample 28% were current smokers. The percentages of current smoking was 32.9% for men and 23.2 for women. 31.5% were ex-smokers (35.7% men and 27.4% women) (Table 1). Regarding gender the higher prevalence in males can mostly be attributed to differences in smoking status. In this study the prevalence of COPD among non-smoking men and women was not significantly different (6% males and 7% females). Figure 1 is depicting the COPD Prevalence among males and females stratified by smoking status. The mean FVC was 4.09±0.64 L for males and 3.12±0.39 L. The mean FEV1 was 3.15±0.66 L for males and 2.27±0.43 L.Mean % predicted FEV_1 was 95.88±5 in non-COPD subjects in

comparison to 70.78±14.98 among COPD subjects. Mean FEV_1/FVC ratio was 78.23±4.44 and 57.80±12.34 for subjects without and with COPD respectively.

DISCUSSION

The key findings of this population based study are that 1/6th of adults aged 40 years and above have Grade 1 or higher COPD. The prevalence of Grade 1, 2, 3 and 4 COPD was 8.8%, 5.2%, 1.4% and 0.6% respectively. Studies conducted worldwide using the same methodology have estimated the prevalence to range from 12% to 26%.[19] The overall prevalence is comparable to studies in four cities of Latin America (12.1%-19.7%) and a study done in Sweden.[18,20] The Prevalence is higher than the prevalence estimated by studies in Japan (10.9%), Poland (10.7%) and China (8.2%) but was lower than Salzburg of Austria.[21-24]

The prevalence was significantly higher in males (19.4%) than females (12.5%). This is consistent with multiple BOLD studies around the world.[21, 25]this can be attributed to fact that both current use of smoking forms of tobacco and well as past history of tobacco use was significantly higher in male gender. Figure 1 showing the prevalence of COPD in both genders by smoking history. In both males as well as females the prevalence in increasing in the order of non-smoker, ex-smoker and current smoker. The prevalence of COPD in non-smoking males and females is almost similar. This points to the fact that the data showing higher prevalence in males is being confounded by differences in smoking history. The prevalence of COPD among women using smoking forms of tobacco was less than the males. This can attributed to the fact that the duration and amount of smoking was less in female gender than males in the study population. Recent studies have projected that in near future the gap between COPD Prevalence in males and females will decrease owing to increase in use of tobacco in women and because women are more vulnerable to develop COPD.[24]

In our study the prevalence varied significantly with the smoking status of the subject. COPD prevalence was 2.7%, 22%, 28.2% in non-smokers, ex-smokers and current smokers respectively. Our study adds to the well documented and growing body of evidence supporting the role of tobacco smoke in COPD. This finding supports this findings of Lea et al, Minas et al, Jindal, Lindberg, et al and multiple other studies.[24,27-29] Worldwide tobacco smoking remains the most important cause of COPD. World health Organization (WHO) estimates that 73% and 40% of COPD mortality is related to smoking in high and low income countries respectively. Consistent with the present understanding of the role of smoking, we found a strong relationship with duration of smoking and COPD.[30]

There was a significant increase in the prevalence of COPD with increase in age. It held true for both males as well as females. The prevalence of COPD increased from 10.6% in 40-49 years age group to 32.8% in subjects aged more than 70 years. The finding is consistent with multiple studies which have also shown an increase in prevalence with age.[31] Physiological reduction of FEV1/FVC ratio with age and cumulative exposure to noxious gases particularly tobacco smoke are important factors for reduction of FEV_1/FVC ratio with age. In addition use of fixed ratio of FEV1/FVC may lead to over diagnosis of COPD particularly in elderly persons.[32]

There was not any significant relationship between socio-economic status, type of fuel being used for cooking at homes and overcrowding with COPD prevalence. Multiple studies have shown lower socio-economic status to be related to COPD.[33,34] There was not any significant relationship of COPD with the predominant type fuel being used currently. Though bio-mass has been shown to be associated with COPD in multiple studies our study had very less number of subjects using biomass as fuel currently.[3] In addition the data related to predominant fuel being used is for only the time during which study was conducted. We did not access the type of fuel being used by subjects in the years before the study. In our study there was not a consistent relationship between overcrowding in residential dwellings and COPD. The finding must be weighed against several weaknesses. The housing data related to one point only. We do not know the overcrowding status for the years preceding the study. Nor do we know how long the subjects lived at the addresses studied.

CONCLUSION

This study concludes that there is a high prevalence of COPD in Kashmir, high prevalence of COPD is attributed to high incidence of tobacco smoking in the study population.

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