RESEARCH ARTICLE

UNDERSTANDING GENDER DIFFERENCES IN THE CLINICAL PRESENTATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A CROSS SECTIONAL STUDY

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ABSTRACT
Background: COPD is projected to become the third leading cause of death by 2030. Tobacco smoke is the biggest risk factor for COPD in developed countries. In a developing country like India, the prevalence of smoking is low in women (3.6% in women and 26.25% in men), however the prevalence of COPD is equal in men and women (2-22% in men and 1.2- 19% in women). The biggest risk factor for COPD in women is exposure to biomass fuel smoke but, the 'awareness of COPD in non-smoking women' is low among treating physicians and hence women with COPD symptoms are diagnosed late leading to increased mortality and morbidity.
Aims & Objective: To evaluate any differences in clinical presentations so that these differences can help in early detection of COPD in women.
Materials and Methods: Cross sectional study in a respiratory disease hospital outpatient clinic. Sampling method was a continuous convenience sampling. We included 200 stable COPD patients both men and women. Data was collected on clinical characteristics of cough, wheeze and breathlessness, lung function parameters of FEV1, FVC and FEV1/FVC, BMI and exercise capacity as assessed by six-minute walk distance. These parameters were then compared in men and women.
Results: 57.5% were men and 42.5% were women. 99% of the men with COPD were smokers, while 2.4% of the women were smokers only (P=0.001). 0.86% of men reported exposure to biomass smoke while 58.8% of women were exposed to biomass smoke (P=0.001). Both presented with cough, sputum, dyspnoea, similar lung functions and BMI. Women reported significant dyspnoea (P=0.04) and had lower exercise capacity as compared to men (P=0.001).
Conclusion: Women with COPD reported higher exposure to biomass smoke and had similar clinical presentations of COPD as men except for dyspnoea and exercise capacity.
Key Words: Biomass Smoke Exposure; Chronic Obstructive Pulmonary Disease (COPD); Dyspnoea; Indoor Air Pollution; Smoking

Introduction

COPD is a common preventable and treatable disease characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles and gases. It is an important Non Communicable Disease (NCD) due to its rising morbidity and mortality worldwide and is projected to become the third commonest cause of death by 2030.[1] Tobacco smoke is the biggest risk factor for COPD in developed countries. In a developing country like India the prevalence of smoking is low in women (3.6% in women and 26.25% in men)[2] but the prevalence of COPD is nearly equal in men and women (2-22% in men and 1.2- 19% in women)[3]. Women, being the principal cook of the family, are exposed to biomass fuel smoke (during cooking) leading to COPD. About 3 billion people (one-half of the world's population) use biomass fuel for cooking and heating.[4] 90% of the rural population of the world and 75% of Indian population (700 million people) use biomass fuel for cooking and heating purposes. By 2030, 54% of Indian population and 52% of other Asian countries will still be using traditional biomass fuel.[5]

Due to burning of these fuels with incomplete combustion, various pollutants are released and >90% are in the inhalable size range.[6] A significant number of chemicals is known to be toxic or have irritant effect on the respiratory tract namely PM10 (Particulate Matter < 10 μ), CO (carbon monoxide), nitrogen dioxide, sulfur dioxide, formaldehyde etc. Among these, PM10 has a significant health impact. In homes using biomass fuel, the mean 24 hrs PM10 levels range from 300 – 3000 ug/m^3 whereas the US Environment Protection Agency (EPA) safety standards are 50ug/m^3 and PM 2.5 (not exceeding 25ug/m^3). Also the mean CO concentration ranges from 2 – 50 ppm to as high as 550 ppm during cooking while the safety levels range for 8 hrs by EPA is < 9ppm or 10mg/m^3.[7] Exposure to IAP (Indoor Air Pollution) may be responsible for nearly 2 million additional deaths in developing countries and for some 4 % of the global burden of disease.[8]

One of the most important health effects of biomass smoke is the development of COPD. But the awareness of "COPD in a non-smoking woman" is low among treating

physicians. Hence women with COPD are diagnosed late – leading to increased mortality and morbidity. Chapman et al reported that due to the prevailing notion that COPD primarily affects men, puts women to a risk of under-diagnosis.[9] The objective of this study was to evaluate the gender differences in clinical presentation of COPD, so that these differences can help the clinician suspect COPD and detect it early, especially in women who are non-smokers. Hence, we evaluated the differences in risk factors, respiratory symptoms, lung function, BMI and exercise capacity in men and women with COPD.

Materials and Methods

This was a cross - sectional study based in a respiratory diseases hospital outpatient clinic and was conducted from January 2011 to September 2012. The facility is a free of cost and the hospital provides services to any patient reporting with respiratory complaints. The sampling procedure was continuous convenience sampling. The study was approved by the Institutional Ethics Committee. After informed consent, we included 200 patients of COPD, both men and women ≥ 40 years of age, and Chronic Obstructive Pulmonary Disease (COPD) was diagnosed by GOLD (Global Initiative for Obstructive Lung Diseases) guidelines 2009.

We excluded patients who had COPD exacerbation within 4 weeks of enrolment, patients with lung resection, asthma, active or healed pulmonary tuberculosis and diagnosis of silicosis, asbestosis and pulmonary fibrosis. Patients eligible for inclusion completed the multidimensional written BOLD (Burden of Obstructive Lung Diseases) questionnaire. This questionnaire captured symptoms of cough, sputum, wheeze and risk factors of smoking and exposure to biomass smoke. Chronic Obstructive Pulmonary Disease was diagnosed by GOLD guidelines 2009 with post – bronchodilator FEV1/FVC (i.e. Forced Expiratory Volume in one second/ Forced vital Capacity) < 70%.[10] The severity of COPD was classified as mild (Post FEV1 ≥80%), moderate (Post FEV1 ≥50 - 80%), severe (Post FEV1 ≥30 - 50%) and very severe (Post FEV1< 30%). Spirometers were according to the specifications and performance criteria recommended in the American Thoracic Society's (ATS) / European Respiratory Society's (ERS) Standardization of spirometry. Spirometers were having the capacity to print FVC tracing, time and volume tracing. All spirometry values were reported at body temperature and pressure, saturated (BTPs). Spirometry was performed as per ATS/ ERS 2005 guidelines.[11]

6 Minute Walk Distance (6MWD), a measure of exercise capacity was performed as per American Thoracic Society (ATS) guidelines[12] and dyspnoea was assessed using the modified Medical Research Council (mMRC) dyspnoea scale[13]. Quantification of exposure to biomass smoke and other inhaled substances like working in a dusty environment was obtained from the patient. The cumulative exposure to biomass smoke was reported in hour years, as average number of hours the patient spent in cooking daily multiplied by number of years of cooking using biomass fuel. The cumulative exposure to tobacco smoke was quantified as pack – years.

Evaluated variables were age, gender, type of risk factor, symptoms of cough and wheeze, grades of dyspnea, FEV1% of post bronchodilator for severity of disease, 6MWD and BMI. We described each variable using mean ± SD. The data collected was analyzed using SPSS for windows version 16 computer software. Pearson's Chi square test and student t test were used to calculate the statistical significance, p value of < 0.05 was considered statistically significant.

Results

A total of 200 patients were enrolled in the study. Table 1 shows patient demographics and risk factors. Both men and women did not differ significantly in average age at presentation to the hospital. None of the men had combined exposure to biomass smoke and tobacco smoke while 38.8% of women had a combined risk factor (figure 1). This finding of risk factor was statistically significant. The mean pack years for men and women were 46.5 (27.5) and 20.82 (13.2) respectively, while mean hour years exposure for men and women were 210 and 315.4 (110.5) respectively, both showing statistical significance.

Table-1: Patient demographics and risk factors

Characteristics	Males COPD	Female COPD	p value
Number	115 (57.5%)	85 (42.5%)	
Age Mean(SD)	63.46 (8.3)	62.09 (6.8)	0.2
Smokers (TS)	114 (99.1%)	2 (2.4%)	0.001
Biomass Smoke (BS)	1 (0.86%)	50 (58.8%)	0.001
Combined (TS and BS)	0	33 (38.8%)	0.001
Pack Years Mean (SD)	46.5 (27.5)	20.82 (13.2)	0.001
Hour - Years Mean (SD)	210	315.4 (110.5)	0.001

TS = Tobacco Smoke; BS = Biomass Smoke

When clinical symptoms were compared in men and women, (Table 2) there was no statistically significant difference in clinical presentation of cough and wheeze. However presentation of dyspnoea differed (figure 2). Women presented with more dyspnoea than men and had a lesser exercise capacity while BMI and the mean

FEV1 did not differ in both groups. See Table 3 for severity of disease.

Table-2: Clinical symptoms, lung function, 6MWD, BMI

Characteristics	Males COPD	Females COPD	p value
Cough n (%)	87 (76.5%)	67 (78.8%)	0.5
Wheeze n (%)	34 (29.5%)	20 (23.5%)	0.3
Dyspnea mMRC	-	-	
Grade 0 n(%)	7 (6.1%)	2 (2.4%)	
Grade 1 n (%)	19 (16.5%)	8 (9.4%)	0.04
Grade 2 n (%)	61 (53.0%)	40 (47.0%)	
Grade 3 n (%)	28 (24.3%)	33 (38.8%)	
Grade 4 n (%)	0	2 (2.4%)	
Post FEV1 Mean (SD)	48.6(16)	44.7 (15.1)	0.08
Post FEV1/FVC Mean (SD)	52.9(11)	56.5(9.4)	0.01
6MWD Mean (SD)	386 (87)	332 (80)	0.001
BMI Mean (SD) Kg/m²	19.4 (3.8)	18.6 (3.6)	
Underweight < 18.5 kg/m²	40%	44.7%	
Normal (18.5 – 24.9 kg/m²)	54.8%	49.4%	0.68
Overweight (25 – 29.9 kg/m²)	4.3%	5.9%	
Obese (≥ 30 kg/m²)	0.9%	0%	

Table-3: Severity of COPD

Grades of COPD	Males	Females
Mild	4 (3.5%)	0 (0.0%)
Moderate	50 (43.5%)	29 (34.1%)
Severe	47 (40.9%)	41 (48.2%)
Very Severe	14 (12.2%)	15 (17.6%)

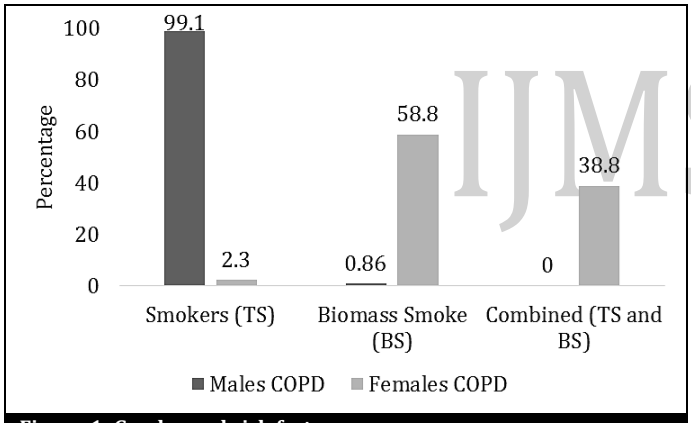

Figure-1: Gender and risk factors

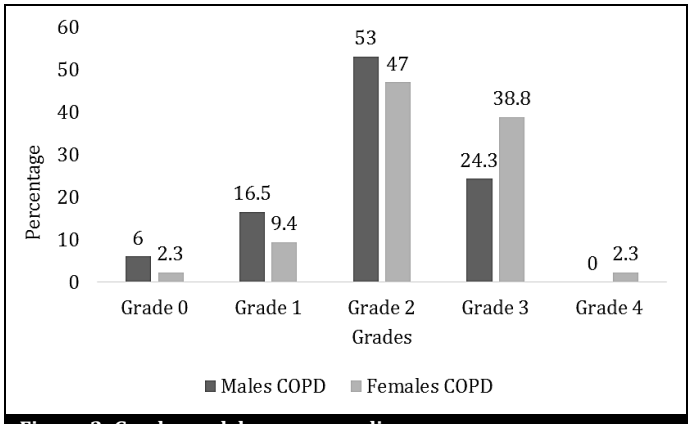

Figure-2: Gender and dyspnoea grading

Discussion

In our study, we identified that 32.9% of the women reporting to the hospital had prior diagnosis of COPD, compared to 89% in men. Worldwide, it is noted that COPD is less likely to be diagnosed in women than men.[14] Keeping this in mind, we conducted the study to assess any differences in clinical presentation of COPD in men and women and found that both men and women presented with similar symptoms of cough and wheeze.

A notable difference was that women presented with more dyspnoea than men. There are differences in the size of the lung, airways and respiratory musculature that account for a decreased maximum ventilatory capacity in women which could probably explain the differences in dyspnoea in men and women.[15] In Confronting COPD International Survey study, it was noted that women were more likely to report severe dyspnoea than men (odds ratio 1.3, 1.10- 1.54) despite significantly fewer pack years of smoking, mean (SD) 36 (29) versus 46(35).[16] Also, women with COPD report more functional dyspnoea for the same degree of airway obstruction.[17] In an article by Meilan K. Han, it is reported that "experiences of dyspnoea has physical, affective and cognitive dimensions and the impact of dyspnoea on patient functioning is influenced not only by degree of lung dysfunction but also by patients emotional response to and higher order interpretation of the sensation".[18] This complaint of dyspnoea if recognized and investigated early by the treating physician may help in early diagnosis of the disease. Similar conclusions were made by Bernd Lamprecht and colleagues.[19]

Several case control studies and cross sectional studies have found an association between COPD and use of biomass fuel.[20-24] In our study, 58.8% of women with COPD were exposed to biomass smoke and 38.8% had combined risk factors. Therefore, biomass smoke associated COPD was found in 97.6% women. In a hospital based study of inpatients of COPD in Nepal, Ramjee Bhandari and colleagues found that 60% were women with exposure to biomass smoke as a risk factor.[25] We also noted that women smoked less than men (mean pack years 20.82 (13.2) versus 46.5 (27.5) and had a higher exposure to biomass smoke (mean hour years 315.4 (110.5) versus 210). This higher exposure in hour-years is because women begin cooking at a very early age.

When age was compared, both men and women presented with a mean age of nearly 62 years. Lung function also did not differ between both groups. Majority had moderate to very severe COPD with women presenting with more 'severe' and 'very severe' COPD.

Compared to men, women were more involved in their family chores and tend to neglect their health needs. As noted in our study, they fail to report to the physician when disease is mild. Our study also showed that women with COPD had a lower exercise capacity than men, an observation similar to that reported by JP Torres.[17] It is noted that during exercise, women reach a critical inspiratory reserve volume earlier, leading to a steep increase in dyspnoea which limits exercise capacity.[26]

There was not much difference in mean BMI in men and women. 40% of men and 44.7% women were underweight. In an Indian study done on clinically stable COPD, 38% of COPD patients were underweight.[27] COPD patients were underweight due to increased work of breathing, hypoxia and effect of inflammatory cytokines.

Our study has some limitations. The findings apply to COPD patients attending an outpatient clinic. As patients with mild symptoms do not report to the hospital, we had relatively small number of patients in mild COPD group. Also very severe COPD patients find it difficult to comply by the follow up, this group also had lesser number in the study.

Conclusion

Women have similar clinical presentation of COPD as men except for dyspnoea. Women report more dyspnoea than men. Biomass smoke exposure is the main risk factor for COPD in women. Hence COPD is to be kept in mind while investigating a case of non-smoking women with symptoms of COPD. As women report with dyspnoea, investigating this symptom for COPD can help in early diagnosis of COPD in women. Providing cleaner fuels or cleaner cook stoves will create a healthy environment and go a long way to prevent COPD in women.

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ABBREVIATIONS

6MWD: Six minute walk distance; ATS: American Thoracic Society; BOLD: Burden of Obstructive Lung Disease; ERS: European Respiratory Society; FEV1: Forced Expiratory Volume in one second; FVC: Forced Vital Capacity; GOLD: Global Initiative for Obstructive Lung Disease; IAP: Indoor Air Pollution; PM10: Particulate Matter < 10 μ

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