ORIGINAL ARTICLE

FREQUENCY AND PREDICTORS OF COPD AND RESTRICTIVE LUNG DISEASE IN PRIMARY CARE

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ABSTRACT

Background: To determine the frequency and risk factors of COPD and Restrictive Lung Diseases in a Primary Care Center in Karachi.

Methods: All patients coming to Primary Health Care Center presenting with cough were enrolled in the study. They were seen by Consultant Family Physician who filled the questionnaires after informed consent. Chest was examined and the patients underwent PEF. If PEF was <70% then office based spirometry test was done. Those who did not achieve reversibility in FEV1 after bronchodilation were labeled COPDers. Data was analyzed using SPSS 20. Mean and standard deviation were taken out for numerical data. Categorical data was shown in frequency and percentage. Chi-square was taken out to see association of risk factors with the outcome. P-value <0.05 was considered significant.

Results: In our study, 54 (35.7%) participants had obstructive lung pathology. Prevalence of COPD came out to be 6.62% whereas7 subjects (4.7%) had restrictive lung disease. COPD was seen more in females as compared to males (84.6% vs 15.4% p-value<0.00). Also smoking had statistically significant association with COPD (42.5% p-value <0.00). All those who had COPD, smoked more than 11 years. Manifestation of the disease with cough (63.3%) and wheeze (33.9%)came out to be statistically significant .Past history of exacerbation of restrictive lung disease(1.3%, p-value 0.054) and MRC dyspnea score of stage 2 (25%, p-value 0.001) revealed statistically significant association with restrictive pathology.

Conclusion: The prevalence of COPD and restrictive lung diseases are soaring at an alarming rate owing to smoking and industrial pollution. It's important to give smoking cessation advice to patients in primary care. A multidisciplinary approach with close cooperation of primary care physician, pulmonologist and cardiologist is imperative to put a halt to these ailments and thus reduce morbidity and mortality.

Keywords: COPD, Bronchodilation, Spirometry, Restrictive Lung Disease, MRC, Dyspnea score.

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INTRODUCTION

The term Chronic Obstructive Pulmonary Disease (COPD) was first used by Dr. William Briscoe at the 9th Aspen Emphysema Conference in 1965, and was a nomenclature coined to encompass the two diseases previously known as Emphysema and Chronic Bronchitis[1]. COPD presents as chronic inflammation of the lungs with the eventual sequelae of respiratory compromise and distress [2-4]. This disease has the hallmark symptoms of breathlessness, excessive sputum production and a chronic cough, which leaves the sufferer with progressively deteriorating respiratory function and a severe decrease in their quality of life[3]. The Global Initiative for Obstructive Lung Disease (GOLD) has recommended that COPD be diagnosed based on the clinical symptoms of chronic bronchitis (cough and sputum production for at least 3 months/year for at least two years) or emphysema (breathlessness and coughing), confirmed by obstructed airflow measured with spirometry[4].

COPD is an emerging burden on the global

healthcare system as it is quickly climbing to become a leading cause of morbidity and mortality. In a study done it was found that COPD alone is responsible for approximately 2.75 million deaths worldwide and the World Health Organization (WHO) has estimated that by the year 2020, COPD will be the 5th leading cause of death and disability[5-6], In 2012 an international survey BREATHE was carried out in 11 countries from North African regions and the Middle East including Pakistan[7] . The survey revealed that the prevalence rate of COPD in those 11 countries was 3.6% and the prevalence rate in Pakistan of COPD was 2.1% in the population aged 40 years and above. According to a retrospective case series study conducted at the Aga Khan University Hospital Karachi, the prevalence of airflow obstruction is 5.7%[8].

The truth of the matter is that the epidemiological findings regarding COPD are severely underestimated due to the fact that patients are not diagnosed as having the disease until it is clinically apparent and fairly advanced5. A good example of this circumstance comes from a Swedish study that estimated that only 20-30% of subjects with COPD who met the COPD criteria had been diagnosed as having COPD . It is due to this reason that epidemiological data on COPD in the Middle East and North African regions is confined and limited to small areas and does not reflect national prevalence estimates.

In contrast to COPD, restrictive lung disease is a significant lung pathology characterized by reduced lung volumes. Lung volumes can be reduced either because of intrinsic factors such as an alteration in lung parenchyma, or because of extrinsic factors including disease of the pleura, chest wall, or neuromuscular apparatus. Most commonly they occur due to interstitial disease of the lung following fibrosis. In case of intrinsic lung disease, the physiological effects of diffuse parenchymal disorders reduce all lung volumes by the excessive elastic recoil of the lungs, relative to the outward recoil forces of the chest wall. Expiratory airflow is reduced in proportion to lung volume. Intrinsic factors include; pneumonia, tuberculosis, lung cancers and sarcoidosis. Diseases of extrinsic structures result in lung restriction, impaired ventilatory function, and respiratory failure (e.g., non-muscular diseases of the chest wall, neuromuscular disorders). Pleural effusion, kyphosis, obesity, ascites and muscular dystrophy are a few examples of pathologies that can cause restricted lung capacity.

The aim of our study therefore is to determine the prevalence of COPD and Restrictive Lung pathologies and to associate key risk factors with them. Any targeted research specific to the prevalence and risk factors of COPD and Restriction in Pakistan is scarce. With the help of self-administered questionnaires we hope to raise awareness about this debilitating disease and to promote a system of early diagnosis and finding and eliminating contributing risk factors.

METHODS

This cross sectional study was conducted in Primary Health Care center Sikanderabad where majority is Pashtun population comprising 100000 people approximately. Study was conducted between June 2017 till May 2018. Sample size was calculated from WHO calculator that came out to be 150.

A modified version of the American Thoracic Society division of lung disease questionnaire was used to record the presence of respiratory symptoms. It included questions regarding frequent cough (defined as presence of cough on most days for 3 consecutive months or more during the year), chronic cough (defined as presence of cough for 3 consecutive months in 2 consecutive years), frequent phlegm (defined as bringing up phlegm on most days of month, for 3 consecutive months or more in a year), chronic phlegm (presence of phlegm for 3 consecutive months in 2 consecutive years), frequent wheezing (whistling sound heard on expiration within 2 years), chronic wheezing (whistling sounds heard on expiration more than 2 years). MRC dyspnea scale is categorized into 5 grades. Grade 0 is not troubled by breathlessness except on strenuous exercise. Grade 1 is short of breadth when hurrying on a level or walking up a slight hill. Grade 2 is walks slower than most people on a level, stops after a mile or so, or stops after 15 min walking at own pace. Grade 3 is stops for breadth after walking 100 yards or after a few minutes on level ground. Grade 4 is too breathless to leave the house or breathless while undressing.

The age, height and sex predicted values of Forced Vital Capacity (FVC), forced expiratory volume in one second (FEV1) and their ratio (FEV1/FVC) were recorded in milliliters (ml) and percentages. Predicted lung volumes i.e. forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and their ratio (FEV1/FVC) were recorded using portable spirometer. Predicted percentage of ≥ 80% for FVC and FEV1 and FEV1/FVC ratio of ≥0.7 were considered as cut off for lung function tests to be normal. These cut-offs are generally used internationally for categorizing lung volumes as normal or abnormal[10].

Obstructive lung function was defined as having FEV1<80% and FEV1/FVC <70% and restrictive lung function was defined as having FEV1<80% and FEV1/FVC >70% .Those whose FEV1 did not improve >12% post bronchodilation were labeled COPDers.

Participants were explained the procedure of spirometry in detail and were allowed to practice

until they felt comfortable. Participants were asked to refrain from smoking for at least 1 hour prior to the procedure. Spirometry was conducted in standing position without nose clips and ATS repeatability criteria were used for quality assessment of the spirometry maneuver. Results of three acceptable readings were recorded and best of the three readings was used for analysis in this study. A trained technician who was also well versed with local language conducted spirometry.

Data was analyzed using SPSS 20. Mean and standard deviation were taken out for numerical data. Categorical data was shown in frequency and percentage. Chi-square was taken out to see association of risk factors with the outcome. P-value <0.05 was considered significant.

RESULTS

Mean age of the study population was 27.67 years with standard deviation of 19.53. 57% of males and 16.7 % of females had some sort of obstruction. Result was statistically significant (p-value 0.000) 55.6% and 84.6% of those who had COPD were males and females respectively. Again statistically significant (p-value0.000).

32.9% of subjects participating in the study had obstruction P -value 0.402 so result was not statistically significant. 69.7% of those with COPD had past history present but the results were insignificant (p-value0.471).

77.8% of those with obstruction had chemical exposure in the past, which was statistically significant (<0.00). 61.1% of those with COPD had chemical exposure but it was not statistically significant (p-value 0.246)(Table 1).

82.5% of those who had obstruction were smokers, which was statistically significant. (p-value <0.00) 42.5% of those with COPD were smokers which was also statistically significant (p-value <0.00) 80% of those with obstructive lung pathology smoked more than 11 years .87.5% , 71.4% and 24.5% with obstruction had smoked 6-10 yrs, 1-5 years and 0 years respectively which is statistically significant (p-value 0.000) Similarly statistically significant results were seen (p-value 0.00) with those who did not achieve reversibility and were labeled COPD. 100%, 37.5%, 28.6% and 75.4% of those who had COPD smoked more than 11 years, 6-10 yrs, 1-5 years and 0 years respectively.

45% of those who had obstructive lung disease and 63.3% of subjects with COPD presented with cough, both statistically significant (p-value 0.000). 71.4% of subjects who had obstruction produced phlegm that was statistically significant(p-value 0.000) 76.2% of subjects with COPD had phlegm but was not statistically significant(p-value 0.376) Obstruction was present in 82.2% of those with wheeze and 33.9% of subjects with COPD were wheezers, both statistically significant results (p-value 0.000) 100% of subjects with COPD had grade 4 dyspnea. 80%, 56.2, 54.0 and 92% of subjects with COPD had mrcdyspnea score of 3,2,1 an0 respectively but the results were not statistically significant p-value 0.049 (Table 2).

39.3% of those with obstructive pathology had pets in their houses and 73.2% of COPDers were pet keepers but the results were not statistically significant, p-value 0.565 and 0.368 respectively.
75% , 61.5 %, 68.2% and 77.8% of those who had COPD had formal education of more than 11 years, 6-10 years, 1-5 years and 0 years respectively but the results were statistically insignificant (p value 0.589).

Frequency of Restrictive Lung Disease was 4.7% in our study. Of those with restriction 6 were females and there was only 1 male. In the diseased population, 1 (1.3%) had past history of restrictive disorder with p- value 0.05 that is statistically significant. Most people with restrictive lung disorder belonged to Pushtoon community 6 (5.7%) and 1(1.3%) was Urdu speaking but the result is statistically insignificant (p value 0.719). 1 person (5.6%) had exposure to chemicals, again statistically insignificant (p-value 0.599) Subjects with restrictive lung disease were mostly illiterate i.e. 5(11.1%), 2(2.3%) had primary education but the relation is statistically insignificant (p-value 0.196). There was only 1 smoker (2.5%) identified with restriction (p value 0.701), but the duration of smoking was less than 1 year(p value 0.57), both statistically insignificant. When clinical presentation was looked upon, cough, phlegm and wheeze was present in 6 (5% p-value 0.9), 1 (4.8% p-value 0.9) and 5 (8.1% p-value 0.104) subjects respectively. MRC dyspnea score came out to be statistically significant (p-value 0.001). Most of the people with restriction had Grade 2 level dyspnea in which one walks slower than most people on a level, stops after a mile or so, or stops after 15 min walking at own pace. They were 4 individuals (25%). 2 (2.1%) had no dyspnea and 1 (10%) was identified with grade 3 dyspnea in which an individual stops for breadth after walking 100 yards, or after a few minutes on level ground.

Table 1: Characteristics of the study population.

Characteristics Mean X (SD)	Frequency (n), Percentage (%)
Age 27.67(19.53)	
Gender	
Male	72 (48)
Female	78(52)
Past History	
Yes	76(50.7)
No	74(49.3)
Ethnicity	
Pushtun	105(70)
Punjabi	12(8)
Sindhi	10(6.7)
Urdu Speaking	23(15.3)
Exposure to Chemicals	
Yes	18(12)
No	132(88)
Completed years of education	
0	
1-5	45(30)
6-10	88(58.7)
≥11	13(8.7)
	4(2.7)
Smoker	
Yes	40(26.7)
No	110(73.3)
Duration of smoking in years	
0	
1-5	118(78.4)
6-10	14(9.3)
>11	8(5.3)
	10(6.7)
Cough	
Yes	120(80)
No	30(20)
Phlegm	
Yes	21(14)
No	129(86)
Wheeze	
Yes	62(41.3)
No	88(58.7)
MRC dyspnea Score	
0	25(16.7)
1	95(63.4)
2	16(10.7)
3	10(6.7)
4	4(2.7)
Obstruction	
Yes	54(36)
No	96(64)
Reversibility	
Yes	44(49.3)
No	106(70.7)
Restriction	
Yes	7(4.7)
No	143(95.3)
Pets	

Table 2: Association of Risk Factors with COPD and Restrictive Lung Disease.

Characteristics	Obstruction n(%)	p-value	COPD (%)	p-value	Restrictive Lung Disease n(%)	p-value
Gender						
Male	41 (57)	0.000	40(55.6)	0.000	1(1.4)	0.72
Female	13(16.7)		66(84.6)		6(7.7)	
Past History	25(32.9)	0.402	53(69.7)	0.471	1(1.3)	0.054
Ethnicity						
Pushtun	39(37.2)		76(72.4)		6(5.7)	0.719
Punjabi	7(58.3)	0.521	5(41.7)	0.135	0(0)	
Sindhi	2(20)		8(80)		0(0)	
Urdu	6(26.1)		17(73.9)		1(4.3)	
Exposure to chemicals	14(77.8)	0.000	11(61.1)	0.246	1(5.6)	0.599
Completed years of education in yrs						
0	13(28.9)	0.695	35(77.8)		5(11.1)	
1-5	32(36.3)		60(68.2)	0.589	2(2.3)	0.196
6-10	7(53.8)		8(61.5)		0(0)	
>11	2(50)		3(75)		0(0)	
Smoker	33(82.5)	0.000	17(42.5)	0.000	1(2.5)	0.701
Duration of smoking in yrs						
0	29(24.5)	0.000	89(75.4)	0.000	7(5.9)	0.574
1-5	10(71.4)		4(28.6)		0(0)	
6-10	7(87.5)		3(37.5)		0(0)	
>11	8(80)		10(100)		0(0)	
Cough	54(45)	0.000	76(63.3)	0.000	6(5)	0.902
Phlegm	15(71.4)	0.001	16(76.2)	0.376	1(4.8)	0.976
Wheeze	51(82.2)	0.000	21(33.9)	0.000	5(8.1)	0.104
Mrc dyspnea score						
0	2(8)		23(92)		2(2.1)	
1	32(34)	0.004	62(64.9)	0.049	0(0)	0.001
2	7(43.8)		9(56.2)		4(25)	

DISCUSSION

The prevalence rate of COPD in our study came out to be 6.6%, which is relatively high as compared to other studies performed within the region, such as BREATH survey and retrospective studies conducting at Aga Khan University, which calculated Pakistan's COPD prevalence rate as 2.1% and 5.7%, respectively [9,10]. The reasoning for that can be attributed to the difference in sample size and the mean age of the participants, which in our study was approximately 28 years.

Smoking is one of the leading risk factors leading to COPD[12] . In our study 40 out of 150 participants were smokers, where 9.3% have been smoking for 1-5 years, 5.3% for 6-10 years and10% for greater than 11 years. 82.5% of them had obstruction and 42.5% had COPD. Smoking came out to be a significant risk factor for developing COPD. The duration of smoking has a linear relationship with COPD and prolonged use of tobacco can be associated with an increase in prevalence of obstructive respiratory diseases. This is something that goes hand in hand with our results as well. A study conducted in 2006 claims in its findings that quitting smoking makes a substantial difference in the severity of COPD, where the number of deaths from COPD in ex-smokers was just 0.6% as compared to that in smokers being 2%[14]. Another study done in 2014 showed that 80% of its participants being smokers, developed mild to moderate disease, and concluded that clinical symptoms like airflow impairment, gas exchange, chronic cough, sputum and emphysema were less prevalent in those COPD patients who were non-smokers and compared to their counterpart smoking group[15]. This is extremely problematic since Pakistan has a high prevalence of smoking, about 15.2%, with the highest prevalence among middle-aged men[16].

On the other hand, in developing countries 25-45% of individuals with COPD have never smoked[17] , therefore it's imperative that other risk factors should also be extensively studied. Lastly, airflow obstruction can also be present among asymptomatic smokers[18] , which means that they do not necessarily show signs of airway obstruction but that does not rule out its presence and may progress systematically with time and age.

In terms of exposure to chemicals and its association as a potential risk factor for COPD, our study showed that 77.8% (P-value: 0.000) of patients with obstruction were exposed to chemicals whereas 61.1% of those with COPD had chemical exposure (P-Value: 0.246), which was not statistically significant. In a study the effects of biofuels for cooking and COPD, use of biofuels increased the chances of COPD among women in Pakistan who used them for cooking[19]. This is extremely alarming since about 3 billion people in the world are exposed to biomass fuels[20]. Another study showed that livestock farmers have 40% higher chances of developing COPD than other farmers due to exposure to different chemicals such as ammonia[21]. Moving on, patients with wood oil and mosquito coil exposures were also seen to have mild to chronic COPD[22]. In a study conducted in Dadu, Pakistan, among brick kiln workers, 17.1% suffered from chronic bronchitis[23], due to the chemicals they are exposed to in these factories. So even though our study did not show significance with COPD and exposure to chemicals as a major risk factor, other studies have.

In a study to examine cough among patients, comparisons showed that smokers with COPD had the highest cough rates (9 coughs/hour) as compared to individuals who had COPD but quit smoking (4.9 coughs/hour) and smokers who had not developed COPD (5.3 coughs/hour)[24]. Our study shows similar results as, 45% of those who had obstructive lung disease and 63.3% of subjects with COPD presented with cough, both statistically significant (p-value 0.000). Moving on, our study showed 71.4% of subjects who had obstruction produced phlegm that was statistically significant (p-value 0.000) 76.2% of subjects with COPD had phlegm but was not statistically significant (p-value 0.376). In another study to assess COPD in individuals with chronic cough/phlegm, 18.9% presented with them and 19.7% reported dyspnea[25]. In our study cough was statistically significant in COPD patients but phlegm was not, and 100% of subjects with COPD had grade 4 dyspnea. 80%, 56.2% 54.0% and 92% of subjects with COPD had MRC dyspnea score of 3,2,1 and 0 respectively but the results were not statistically significant (p-value 0.049).

In our study, 39.3% of those with obstructive pathology had pets in their houses and 73.2% of COPDers were pet keepers but the results were not statistically significant, p-value 0.565 and 0.368 respectively. A similar trend was seen in a study conducted to assess the trigger factors of COPD where ownership of pets was not significant[26].

In our study, the number of years of schooling and education showed no correlation or significance with COPD, but a study in Copenhagen associated that the lesser the years of education they individuals in the study received, correlated with poorer prognosis of COPD[27].

When clinical presentation of restrictive lung disease was looked upon, cough, phlegm and wheeze was present in 6(5% p-value 0.9), 1(4.8% p-value 0.9) and 5(8.1% p-value 0.104) subjects respectively. Whereas in severe cases, patients may also be examined for cyanosis, finger clubbing (indicative of idiopathic pulmonary fibrosis) and features of systemic disease, such as Raynaud's

phenomenon and polyarthropathy.[28]

Other Studies done previously have shown that patients with restrictive lung disease are typically dyspneic and have an increase in overall respiratory center drive, which appears to result from increased lung elasticity[29]. Thus, in this study MRC dyspnea scale was used which is categorized into 5 grades and the score came out to be statistically significant (p-value 0.001) further verifying presence of dyspnea as a vital symptom of the condition. Pulmonary rehabilitation has been tested to be an effective method to improve dyspnea in such patients.[30]

This study also aimed at determining the relation of restricted lung disease to chemical exposure and smoking. Adverse Effects of smoking and chemical exposure on lungs have been widely researched over the years. Manuel et al studied lungs from 25 smokers to examine the histological changes due to smoking in small airways. The specific morphologic features separating smokers from nonsmokers were increases in goblet cell metaplasia ($p < 0.001$), smooth muscle hypertrophy ($p < 0.05$), inflammation in the walls of bronchioles ($p < 0.01$), and respiratory bronchiolitis ($p < 0.001$)[30]. In another study, inflammatory changes associated with metaplasia of the membranous bronchioles' mucosal epithelium and intraluminal macrophage accumulation were observed in the lungs of smokers, the remodeling of the airways leads to fibrotic changes in the parenchyma. Fibrosis amongst others is a major factor causing restricted lung pathology. At low magnification, the key finding was a distinctive pattern of airway-centered interstitial fibrosis centered on membranous and respiratory bronchioles in most restrictive lung diseases. However, in this research out of the 7 patients with the disease, there was only 1 smoker (2.5%) identified with restriction (p value 0.701), but the duration of smoking was less than 1 year (p value 0.57), thereby both values are statistically insignificant.

CONCLUSION

It is imperative to look deeper into the causes of COPD. Second hand smoke is also contributing to Chronic Obstruction. Smoking cessation intervention programs should be conducted so as to curb the nip in the bud and prevent such a debilitating disease. Correct inhaler technique should also be reinforced to the users so that long term maintenance could be achieved.

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