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Prevalence And Risk Factors For Coronary Artery Disease In Patients Of Chronic Obstructive Pulmonary Disease.

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ABSTRACT

CAD and COPD are related closely, as they share common causative risk factors. COPD related systemic inflammation adds to the CAD risk. CAD may therefore be common in COPD but often silent. To study the prevalence of CAD in COPD and study the risk factors. This was a cross sectional study which was carried out using a semi-structured questionnaire along with a complete cardiac assessment to evaluate for the presence of associated CAD in 200 patients of COPD diagnosed by GOLD criteria. 89/200 (44.5%) had abnormal ECG/2D echocardiogram suggesting CAD. 17 /89 patients who underwent coronary angiography had significant blocks confirming the diagnosis of CAD. Out of 200 cases, 87/200 (43.5%) were tobacco smokers and 113/200 (56.5%) had biomass fuel exposure. Incidence of CAD correlated with smoking index as well as severity of airflow obstruction (p-value <0.05). Risk of CAD is high in COPD and seems to increase with COPD severity and smoking index.

Keywords: COPD, CAD, Smoking.

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INTRODUCTION

GOLD defines Chronic Obstructive Pulmonary Disease (COPD) as a common, preventable and treatable disease that is characterised by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development.[1] It is now well established that COPD is a chronic inflammatory condition with significant extra-pulmonary manifestations.[2] In the Lung Health Study, which examined nearly 6,000 smokers whose FEV_1 was between 55% and 90% predicted, cardiovascular diseases were the leading cause of hospitalization, accounting for nearly 50% of all hospital admissions, and the second leading cause of mortality, accounting for a quarter of all deaths.[3]

The relationship between COPD and Coronary Artery Disease (CAD) is far more complex than the simple co-existence of both diseases in the same individual and airflow limitation is considered as an important contributor. Although COPD and CAD have common causal factors, primarily smoking, the increase of CAD in patients with COPD is independent of these known risk factors.[4] The exact mechanism linking COPD to heart disease is not yet known, but systemic inflammation, oxidative stress and hypoxemia are the major putative candidates.

The precise prevalence of CAD in patients of COPD is unknown. Hence, there was a need to study the prevalence of CAD in COPD, so that early therapeutic measures can be instituted in these patients.

MATERIALS AND METHODS

This was a cross-sectional study which included randomly selected adult male and female patients above the age of 50 years, diagnosed as stable COPD based on GOLD criteria and willing to give written and informed consent admitted in the In Patient Department (IPD) of Respiratory Medicine, Dr. D. Y. Patil Medical College, Pimpri, Pune between September 2018 and August 2020.

Patients who were unable to perform spirometry or with pre-existing diffuse pulmonary diseases other than COPD or chronic kidney disease, thyroid disease, severe anemia, severely immuno-compromised patients or with previous history of CAD who has undergone CABG or PTCA or with hypersensitivity to contrast agent used in Coronary Angiography (CAG) were excluded from the study.

The 200 selected subjects were administered a semi-structured questionnaire which included demographic data (age, gender), history of smoking (including current status of smoking), history of biomass fuel exposure, symptoms suggestive of COPD (dyspnea, cough), symptoms suggestive of CAD (dyspnea, orthopnea, paroxysmal nocturnal dyspnea, palpitations and chest pain).

A post bronchodilator spirometry was performed on all selected patients using an electronic spirometer (COSMED Pulmonary Function equipment – Model Quark PFT 2008) to confirm the diagnosis of COPD as per GOLD criteria. The standardization of spirometry was based on ATS/ERS task force joint statement on standardization of spirometry (2005).

All the study patients were then subjected to a complete cardiac assessment which included Electrocardiography (ECG), 2D Echocardiogram (LVEF and RWMA), Coronary Angiography (patients who consented for the same based on cardiologist opinion) and cardiologist consultation to confirm the diagnosis of CAD. All patients who were diagnosed as CAD were sent to a cardiologist for further evaluation and management.

RESULTS

All the 200 patients were above the age of 50 years with the maximum number of patients being in the age group of 50-60 (42%). Baseline demographics and clinical findings of all the study patients have been outlined in Table 1 and Table 2 respectively. The mean smoking index among smokers was 302.55 and majority of the patients with biomass fuel exposure who developed COPD had at least more than 20 years of exposure (97.3%).

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Table 1: Baseline Characteristics of Study Participants

Variables	Frequency	Percentage
Age Distribution		
50-60	84	42
61-70	75	37.5
71-80	33	16.5
81-90	7	3.5
91-100	1	0.5
Gender		
Male	87	43.5
Female	113	56.5
Smoking Index		
< 100	1	1.1
100-300	51	58.6
> 300	35	40.2
Biomass Fuel Exposure		
Yes	113	56.5
No	87	43.5
CAD		
Present	89	44.5
Absent	111	55.5

Table 2: Clinical Findings of Study Participants

Variables	Frequency	Percentage
Symptoms		
Chest Pain	36	18
Dyspnoea	198	99
Orthopnoea	59	29.5
PND	51	25.5
Palpitations	12	6
Bilateral Pedal Oedema	60	30
ECG Findings		
Sinus Rhythm	123	61.5
'ST' segment Elevation	1	0.5
Other Findings	76	38
2D Echo Findings		
LVEF <40%	7	3.5
LVEF 40-60%	71	35.5
LVEF >60%	122	61
RWMA Observed	22	11

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Table 3: CAD Distribution in relation to various study variables

Variables	CAD Present	CAD Absent
Gender		
Male	45	42
Female	44	69
Smoking Index		
<100	0	1
100-300	35	25
>300	18	16
Chest Pain		
Yes	36	0
No	53	111
COPD Severity		
GOLD 1	0	4
GOLD 2	27	74
GOLD 3	52	30
GOLD 4	10	3

CAG was advised in 89/200 (44.5%) patients as they did have high clinical probability of having CAD based on symptoms, ECG findings and 2D Echocardiography (LVEF and RWMA) findings. CAG in 72/89 patients was not done due to financial constraints or negative consent. However, based on high clinical suspicion and based on ECG and 2D Echo findings, these 72/89 patients were labelled in the category of 'Probable CAD'. The remaining 17/89 patients who underwent CAG had catheter diagnosed CAD; 6 patients (3%) had SVD, 10 patients (5%) had DVD and 1 patient (0.5%) had TVD. Hence, 89 (44.5%) out of 200 patients in the study group seemed to have CAD with COPD.

The prevalence of CAD in comparison to various study variables like gender, smoking index, chest pain and severity of airflow obstruction (GOLD) has been outlined in Table 3.

DISCUSSION

COPD is a leading cause of morbidity and mortality worldwide. A large share of morbidity and mortality in COPD is associated with complications related to the cardiovascular system. CAD and COPD are related closely, both clinically and epidemiologically. Common risk factors, role of inflammation in pathogenesis of both conditions and role of defective repair and ageing have been postulated to explain this relation. It has been shown in many studies that the prevalence of CAD is higher in patients of COPD than in the general population. Non treatment of CAD in patients of COPD puts them at increased risk for adverse cardiovascular events and death. Despite the growing appreciation of the importance of CAD in COPD[1], there is still considerable ambiguity about their prevalence and impact, especially in the COPD population; hence this study.

It was observed that in the study group, 87 patients (43.5%) were males and 113 patients (56.5%) were females. In India, the overall prevalence of COPD was found to be 5% in male and 2.7% in female population with a median male-to-female ratio of 1.6:1.[5] However, in our study the probable reason for more female COPD patients could probably be because of the fact that our hospital is located in Pimpri, Pune which is a tertiary care centre that caters to a large part of the rural population of Pimpri-Chinchwad and Pune Rural watershed areas. These areas have females in large numbers who have history of on-going or past biomass fuel exposure which poses as a major risk factor in developing COPD. It was observed that 87 patients (43.5%) in the study group were smokers. In a study by Jindal et al., they reported a smoking prevalence of 28.55% in men and 2.1% in females.[5]

The number of COPD patients diagnosed with CAD was significantly higher among moderate and heavy smokers. Also, the p-value of 0.048 (<0.05) proved that higher the smoking index, higher is the probability of having CAD with concomitant COPD. Hence, early and strong emphasis on smoking cessation will provide the only chance for reducing lung damage in COPD[3]. The benefits of smoking cessation in both CAD and COPD cannot be over emphasized. It has been shown that providing objective data like spirometric demonstration of loss of lung function to patient results in better outcomes with smoking cessation[6].

It was observed that 113 (56.5%) patients had history of biomass fuel exposure. Exposure to wood or charcoal smoke was found to be strongly associated with COPD in a dose-response pattern in a study by Orozo-Levi *et al*[7]. In India, exposure to smoke from biomass fuels and wood used for cooking has been found to be a major risk factor for development of COPD in women[5].

At the end of the cardiac assessment in our study, the prevalence of CAD among COPD patients was 44.5%. This was higher in comparison to the general population. Increased inflammation may be the reason for increased prevalence of COPD in CAD[8]. It has been estimated that the prevalence of CAD in patients with COPD may vary from as less as 20% to even over 60%, depending on the characteristics of the study population[9,10]. A study in China also showed that COPD was associated with multi vessel involvement[8]. While Ahmad *et al*.[11] found 73% of patients with COPD and CAD had single-vessel disease, whereas only 66% of the non-COPD CAD patients had multi vessel disease.

In our study, 36 (40.4%) patients of CAD with COPD complained of chest pain prior to the cardiac assessment whereas 53 (59.5%) of the COPD patients did not complain of chest pain but was later diagnosed to have CAD. This shows that chest pain alone as a symptom cannot be used to rule out presence of CAD in a COPD patient and a complete cardiac assessment is required to rule out CAD in COPD patients.

52 (58.4%) out of the 89 COPD patients with CAD were in GOLD Stage 3 (Severe) whereas the majority of the patients with only COPD (63%) were in GOLD Stage 2 (Moderate). The p-value of 0.0035 (<0.05) showed that there was a significant probability of COPD patients of lower FEV_1 to have CAD. Das *et al*. showed the prevalence of 51.2% of COPD in CAD with most of these cases of COPD of moderate-to-severe degree. They found a positive correlation between severity of COPD and impaired left ventricular functions[12]. Hole and colleagues[13] from the United Kingdom showed that reduced FEV_1 accounted for 26% of all deaths related to ischemic heart disease in men and 24% in women and the magnitude of the mortality burden attributed to reduced FEV_1 was similar to the burden imposed by hypercholesterolemia.

CONCLUSION

The under diagnosis of CAD in COPD patients puts unnecessary additional disease burden on these patients and prevents them from the benefits of early institution of treatment. To improve the situation, at the time of diagnosis of COPD, the initial evaluation protocol should include a detailed history, clinical examination and cardiac assessment. As the prevalence of CAD in COPD patients is substantial and institution of proper treatment benefits both conditions, it is important that efforts to diagnose this condition should be made at the time of initial evaluation.

There were few limitations to our study. Firstly, as it was a cross-sectional study, causality of the association between COPD and CAD cannot be commented upon. Secondly, the patients who get admitted in our IPD usually have advanced COPD and hence, selection of patients from this group is likely to have caused a selection bias. Lastly, exclusion of unacceptable spirograms could have likely led to the exclusion of some patients with advanced disease and likely to have led to the underestimation of the CAD prevalence.

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