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INCIDENCE OF CORONARY ARTERY DISEASE AMONG COPD PATIENTS WITH UNCONTROLLED DYSPNOEA DESPITE OPTIMAL BRONCHODILATOR THERAPY

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ABSTRACT

Introduction: Both coronary artery disease (CAD) and chronic obstructive pulmonary disease (COPD) have high rates of morbidity and mortality. Systemic inflammation, as demonstrated in several studies of COPD patients, is also associated with atherosclerotic plaque formation. Various studies had demonstrated varying incidence of CAD among COPD patients. However, it is unclear that how much contribution of CAD is responsible for the worsening of COPD symptoms.

Aim & objective: To assess the incidence of coronary artery disease in individuals with COPD who have uncontrolled dyspnoea even with the optimal bronchodilator treatment

Materials & Methods: This study used a cross-sectional design and was an observational study conducted in a hospital. This study was carried out on established COPD patients with uncontrolled dyspnoea despite optimal bronchodilator therapy for > 3 months with good adherence. History of typical angina, moderate to severe pulmonary hypertension, established CAD without revascularization or left ventricular systolic dysfunction (EF<50%) cases were excluded. Finally, 120 consecutive patients fulfilling the selection criteria were includes and underwent coronary angiography.

Result: The study population was male predominant (67.5%), coronary angiography showed 78 out of 120 (65%) COPD patients who had uncontrolled dyspnoea despite optimal medical management for COPD, had critical coronary artery disease. Among various common risk factors smoking and diabetes were significantly associated with critical CAD (p value 0.00023 and 0.0045 respectively). Ischaemic pattern in ECG was present only in 48.3% cases.

Conclusion: Significant co-association of critical CAD was found in COPD patients who remained symptomatic despite adequate bronchodilator medication; therefore, coronary angiography should be done in those cases.

Keywords: COPD, Coronary artery disease, dyspnoea, coronary angiography

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) and coronary artery disease (CAD) both have significant impact on morbidity and mortality. By 2030, COPD will be the direct cause of 7.8% of all deaths and 27% of deaths related to smoking, only exceeded by 33% and 29% for cardiovascular disease and cancer, respectively [1,2]. Comorbid conditions, such as coronary artery disease (CAD) are frequent in COPD patients. These conditions might make therapy more difficult and raise the morbidity and death rates of the affected population.

Conventional cardiovascular risk factors, which are very prevalent in COPD patients and may accelerate the disease's development, include smoking, hypertension, diabetes, and dyslipidemia [3]. Given that decreased lung function has been demonstrated to be a risk factor for CHD irrespective of smoking, it seems doubtful that the coexistence of COPD and CHD can be explained solely by similar risk factors. Numerous studies involving COPD patients have shown presence of chronic systemic inflammation, which is also known to be linked to the development of plaque and atherosclerosis [4,5]. Endothelial dysfunction and elevated arterial stiffness are two possible modifiable pathways of cardiovascular morbidity and death in COPD patients [6].

Studies have shown that the incidence of CAD in COPD patients varies, ranging from 1.2% to 70%, and is mostly demonstrated in individuals with stable COPD patients [7-9]. This broad variation could result from a misclassification caused by an overlap in the spectrum of clinical presentations and a lack of standardised diagnostic criteria, which would prevent invasive coronary angiography from being performed in every instance. The current study

focused on the subset of patients with established COPD in whose dyspnoea remained uncontrolled despite receiving the best care possible for the condition.

MATERIALS & METHOD

Objective

- To find out Incidence of coronary artery disease among COPD patients with uncontrolled dyspnoea despite optimal bronchodilator therapy

Study design

- This hospital based observational study, cross sectional in design

Sample size and sampling method

- 120 consecutive patients fulfilling the selection criteria

Inclusion criteria

- COPD patients (post bronchodilator FEVI/FVC<0.7) with uncontrolled dyspnoea (mMRC ≥2) despite optimum bronchodilator therapy according to GOLD 2021 report with good adherence for ≥3 months
- Increase in dyspnoea (mMRC ≥2) in previously stable COPD patients (mMRC 0-1) without significant deterioration of lung function (within same GOLD Category)
- No history of anginal chest pain.

Exclusion criteria

- typical anginal chest pain
- Patients with low left ventricular ejection fraction (LVEF ≤50%),
- moderate to severe pulmonary hypertension (estimated PASP >50mm of Hg by echocardiography)
- known coronary artery disease without revascularization or history of myocardial infarction.

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Procedure

Coronary angiography was done after obtaining informed consent

Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests.

Z-test (Standard Normal Deviate) was used to test the significant difference of proportions.

Explicit expressions that can be used to carry out various *t*-tests are given below. In each case, the formula for a test statistic that either exactly follows or closely approximates a *t*-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test.

Once a *t* value is determined, a *p*-value can be found using a table of values from Student's t-distribution .If the calculated *p*-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.

p-value ≤ 0.05 was considered for statistically significant.

RESULT

Table 1: Distribution of Critical CAD

CAG Reports	**Critical CAD**
Normal	15(12.5%)
Non critical CAD	27(22.5%)
Critical SVD	22(18.33%)
Critical DVD	24(24.0%)
Critical TVD/multi vessel CAD	32(26.66%)
Total	120(100.0%)

Table 2: Distribution of Presence of ECG changes in study population

ECG pattern	Number
Normal	34 (28.3%)
Non-specific ST-T changes	28 (23.3%)
Ischemic pattern ST-T changes	58 (48.3%)
Total	120(100.0%)

Table 3: Association of risk factors with critical CAD

RISK FACTOR	CAD (n=78)	NON CAD (n=42)	P Value
Smoking	55(70.5%)	15(35.7%)	0.00023
DM	59(75.6%)	21(50%)	0.0045
HTN	45(57.7%)	27(64.3%)	0.4819
Dyslipidemia	36(46.2%)	26(61.9%)	0.0996

Among 120 patients 81 (67%) were male and 39 (33%) were female. Mean age of study population was 65.7 years. Smoking, hypertension, diabetes and dyslipidaemia were present in 70(58.3%), 72 (60%), 80 (66%) and 62 (51.7%) cases respectively. Coronary angiography revealed 15(12.5%) patients had Normal coronaries, 15(12.5%) patients had Non critical CAD, 22(18.33%) patients had Critical single vessel disease (SVD), 24(24.0%) patients had Critical double vessel disease (DVD) and 32(26.66%) patients had Critical TVD/multi vessel

CAD**.** Overall critical CAD was present in 78 (65%) cases. In our study, 34 (28.3%) patients had Normal ECG pattern, 28 (23.3%) patients had Non-specific ST-T changes and 58 (48.3%) patients Ischemic pattern ST-T changes. Overall, typical ST-T changes were present in 50 out of 78 critical CAD patients (64.1%). The value of z is 4.0385. The value of p is < .00001. The result is significant at $p < .05$.

In critical CAD (n=78), 55(70.5%) patients were Smoker. In non-critical CAD/ non-CAD (n=42), 15(35.7%) patients were Smoker. Association of smoking with critical CAD was statistically significant (p=0.00023). In critical CAD, 59(75.6%) patients had DM. In non-critical CAD/ non-CAD, 21(50%) patients had DM. Association of risk DM with critical CAD was statistically significant (p=0.0045). In critical CAD, 45(57.7%) patients had HTN and 36(46.2%) patients had dyslipidaemia. Association with critical CAD was statistically not significant in respect to these risk factors (p=0.4819 & p=0.0996 respectively).

DISCUSSION

"Dyspnoea on exertion" is now considered "angina equivalent". So, dyspnoea not relieved with optimal bronchodilator therapy should have high suspicion of significant CAD. A number of studies demonstrated a large variation of CAD prevalence in COPD patients, but no study targeted specific subgroup of highly suspected CADs where urgent cardiac intervention may be needed.

Agostini AJ et al [10] (2002) showed that In the US, two of the leading causes of mortality and disability are chronic obstructive pulmonary disease (COPD) and coronary artery disease (CAD). Heart disease is the top cause of mortality for people over 65, with COPD coming in at number four.

Hong Y et al [11] (2019) studied "the association between chronic obstructive pulmonary disease and coronary artery disease in patients undergoing coronary angiography". They had found the mean age of COPD patients was 63.3 ± 12.2 years, and 74.8% were male. the prevalences of CAD in patients with COPD was 86.6%. Half of the subjects with COPD had multivessel diseases.

In a recent study, **Ahamed W et al [12] (2024)** showed that the overall prevalence of angina pectoris was higher among individuals with COPD (9.6% vs. 5.8%) and asthma (9.9% vs.

5.7) than those without COPD and asthma, respectively. But they had diagnosed angina based on clinical questionnaire and no CAG was performed to confirm the extent of CAD.

In this current study the mean age of study population was 66.7 years with a male predominance (67.5%) in the study population. However, gender didn't show any significant correlation with CAD (p- 0.337). Coronary angiography revealed Critical coronary artery disease in 65% (78 out of 120 cases) highly symptomatic COPD patients. 50.6% patients had critical blockage in more than 1 coronary artery and 26.66% patients had Critical TVD/multi vessel CAD.

Agostini AJ et al [10] also concluded that a significant portion of COPD patients smoke, and smoking has been linked to the development of CAD etiologically. Smokers with CAD also have a higher risk of acute coronary events. In current study, 70.5% of critical CAD patients were smoker. Association of smoking was statistically significant. Moreover, long standing diabetes patients with neuropathy may not have chest pain due to neuropathy. Our study showed 75.6% patients with critical CAD had diabetes and the association with diabetes was statistically significant (p=0.0045).

Our study has some limitations. Normal or non-critical CAD patients were not followed up as follow up was not included in the study protocol. They might have other confounding factors attributing to persistent dyspnoea. In spite of normal epicardial coronaries patient might have microvascular angina which could not be assessed. As this study targeted specific subgroup of established COPD cases with small samples, this data couldn't be reflected overall prevalence of CAD among COPD patients. In order to investigate the overall impact of CAD on prognosis of COPD patients, more studies with larger samples and follow up would be needed.

CONCLUSION

We observed that, even with adequate bronchodilator medication, a notable number of COPD patients had uncontrolled dyspnoea. Coexisting CAD might make breathing problems worse and make therapy more difficult to achieve. In these patients, active surveillance for CAD in the form of coronary angiography should be done in order to enable prompt intervention and enhance overall patient care. To investigate the underlying processes and potential therapy approaches that target both illnesses at the same time, more study is required.

REFERENCES

1. Hillas G, Perlikos F, Tsiligianni I, Tzanakis N. Managing comorbidities in COPD. Int J Chron Obstruct Pulmon Dis. 2015;10:95–109
2. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med.* 2006; **3**: e442.
3. Sin DD, Anthonisen NR, Soriano JB, Agusti AG. Mortality in COPD: Role of comorbidities. *Eur Respir J*. 2006;28(6):1245–57.
4. Eagan TM, Ueland T, Wagner PD, Hardie JA, Mollnes TE, Damas JK, et al. Systemic inflammatory markers in COPD: results from the Bergen COPD Cohort Study. *Eur Respir J*. 2010;35(3):540–8.
5. Rabe KF, Hurst JR, Suissa S. Cardiovascular disease and COPD: dangerous liaisons? *Eur Respir Rev*. 2018;27(149).
6. Maclay JD, MacNee W. Cardiovascular disease in COPD: mechanisms. Chest. 2013 Mar 1;143(3):798-807.
7. Lange P, Mogelvang R, Marott JL, Vestbo J, Jensen JS. Cardiovascular morbidity in COPD: A study of the general population. *COPD*. 2010;7(1):5–10.
8. Vaz Fragoso CA, Van Ness PH, Murphy TE, McAvay GJ. Spirometric impairments, cardiovascular outcomes, and noncardiovascular death in older persons. *Respir Med*. 2018;137:40–7.
9. Mota IL, Sousa ACS, Almeida MLD, de Melo EV, Ferreira EJP, Neto JB, et al. Coronary lesions in patients with COPD (Global Initiative for Obstructive Lung Disease stages I-III) and suspected or confirmed coronary arterial disease. *Int J Chron Obstruct Pulmon Dis*. 2018;13:1999–2006.
10. Agostini AJ, Gradman AH. Managing angina in patients with COPD: Will respiratory symptoms be worsened by antianginal therapy?. Journal of Respiratory Diseases. 2002 Feb 1;23(2):71-8.
11. Hong Y, Graham MM, Southern D, McMurtry MS. The Association between Chronic Obstructive Pulmonary Disease and Coronary Artery Disease in Patients Undergoing Coronary Angiography. *COPD*. 2019;16(1):66–71.
12. Ahmed W, Dixit P. Effect of chronic lung diseases on angina pectoris among Indian adults: longitudinal ageing study in India. Sci Rep. 2024;14(1):2372.