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Prevalence of Diabetes and Hypertension among Chronic Obstructive Pulmonary Diseases Patients at a Tertiary Care Centre

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized 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. HT and DM have been recognized to coexist with COPD. Several risk factors have been associated with HT and DM in people with COPD: Smoking, systemic inflammation, obesity and physical inactivity. **Objective:** To estimate Prevalence of diabetes and hypertension in Chronic Obstructive Pulmonary Diseases amongst study participants. **Material and Method:** The Cross-sectional study was conducted on 161 diagnosed COPD patients from August 2017 to December 2019 in Department of Respiratory Medicine Medical College and Tertiary Health Care Institute Nashik was included. Written informed consent was taken from all study participants and those who gave consent were enrolled in the present study. **Result:** Out of 161 COPD patients, prevalence of hypertension was 45.96% while prevalence of DM was 22.36%. The Highest prevalence of DM in Female (33.33%), HTN in Male (48%) and both DM and HTN in Female (8.33%), active smokers were mostly associated with DM and/or HTN. In stage IV (71), DM, HTN and both DM and HTN were recorded in maximum no. of cases, whereas in patients of Stage I - COPD least level were found. Increase association of DM and/or HTN increases with severity of obstruction. **Conclusion:** Prevalence of HTN was recorded more than DM. DM and HTN were found to be more prevalence in severe and very severe COPD patients. The COPD patients should be screened for DM and HTN at the time of diagnosis to prevent DM and/or HTN related complications in COPD patients.

Keyword: Association, COPD, DM, HTN, Prevalence

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized 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[1].

Smoking, passive smoking, reactivity of airways, air pollution and occupational are risk factors for COPD[2]. Independent risk factors for COPD are male gender, advanced age, low socioeconomic status, occupational exposure and cigarette smoking[3] .A link between diabetes, hypertension and COPD has been observed in several cross sectional and longitudinal studies and the syndrome has been identified as an independent risk factor for worsening respiratory symptoms, increasing lung function impairment, pulmonary hypertension and asthma[4]. How diabetes, hypertension develops in people with COPD has not been clearly elucidated, but it has been postulated that obesity, smoking and systemic inflammation may play a role in its development[5]. COPD once considered primarily a pulmonary disease, it is now associated with a variety of systemic manifestations[6].

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HT and DM have been recognized to coexist with COPD. Several risk factors have been associated with HT and DM in people with COPD: Smoking, systemic inflammation, obesity and physical inactivity[5]. Smoking, the principal risk factor for developing COPD, has been considered to be one of the main causes of increased systemic inflammation, which explains the connection between DM, HT and COPD[7]. Systemic inflammation promotes insulin resistance, which contributes to the development of DM in people with COPD[8]. In addition to the risk factors mentioned, physical inactivity increases the chance for people with COPD to develop DM, HT and complicates the condition[5]. Several studies have compared the level of physical activity in people with COPD with healthy controls or people with other chronic diseases and found that people with COPD were extremely sedentary and less active than people with other chronic diseases[9]. All of the factors reviewed above have some influence in the development of DM, HT in people with COPD.

Several demographic and clinical factors have been associated with DM, HT in the general population and people with chronic diseases. Older age has been significantly associated with increasing the prevalence of DM, HT in the general population[10].

2. Aims and Objectives

1. To study Prevalence of hypertension in Chronic Obstructive Pulmonary Diseases.
2. To study Prevalence of diabetes in Chronic Obstructive Pulmonary Diseases.
3. To study association of diabetes and/or hypertension with severity of Chronic Obstructive Pulmonary Diseases

3. Material and Methods

This is cross sectional study comprising 161 patients diagnosed with COPD from Dr. Vasantrao Pawar Medical College and Research Centre, Adgaon Nashik. The study was carried out from August 2017 to December 2019 in Department of Respiratory Medicine in a tertiary care center and medical college. Written informed consent was taken from all study participants, and those who given consent were enrolled in the present study.

Minimum of 161 patients was included in the study, after satisfying the eligibility criteria which is as follows:

Formula for Sample Size Calculation:

$$\text{Sample Size for One Proportion} = \frac{Z^2 (P \times Q)}{L^2}$$

Where,

Z = Critical Value = 1.96

P = Proportion of patients

Q = (1-P)

L = Allowable error = 0.05

3.1 Inclusion Criteria

- Age group 40 yrs irrespective of genders with diagnosed COPD cases.
- Patients with or without diagnosed diabetes and hypertension

Patients giving informed consent.

3.2 Exclusion Criteria

- Patients having other lung diseases apart from Chronic Obstructive Pulmonary Diseases.

The COPD patients were divided in groups with both DM, HTN with either DM or HTN and with neither DM nor HT. To study association of diabetes and hypertension with severity of Chronic Obstructive Pulmonary Diseases amongst study participants.

Based on the modified National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria proposed by the American Heart Association (AHA)/National Heart Lung and Blood Institute (NHLB) (2005) which included the following parameters to ascertain the presence of HT and DM[11].

- SBP ≥ 130 mmHg or DBP ≥ 85 mm of Hg or antihypertensive treatment with a history of hypertension and fasting glucose level of ≥ 110 mg/dl or drug treatment for elevated glucose levels.

3.3 Statistical Analysis

All the collected data was entered in Microsoft Excel sheet and then transferred to SPSS software version17 for analysis. Qualitative data was presented as frequency and percentages and analyzed using chi-square test. P-value <0.05 was taken as level of significance.

4. Observation and Result

The present study revealed that the prevalence of HTN (45.96%) and DM (22.36%) in study population, so there is significantly *higher number* of *study* subjects who were *hypertensive* as represented in Table no.1. This is depicted in Figure 1.

As seen in the above table, most of the study population belonged to the age group of 60 to 69 years (39.7%) followed by 51 to 59 years (30.34%), ≥ 70 years (24.78%) and 40 to 50 (4.9%). The highest prevalence is of DM (28.12%), HTN (51.56%) in age group 60 to 69 years and both DM and HTN (10%) in age ≥70 years as represented in Table.1. This is depicted in Figure 1.

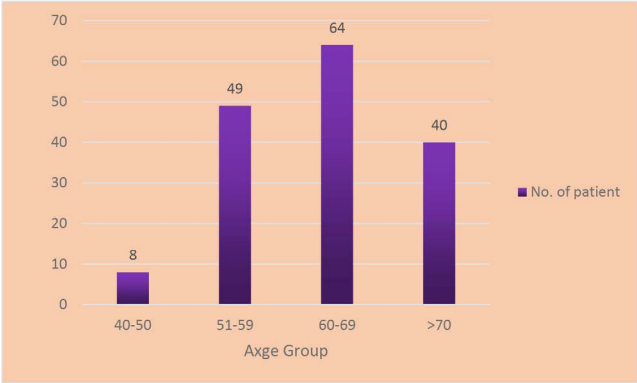

Figure 1. Age wise distribution of DM and/ HTN in COPD cases of study population.

The present study revealed that majority cases were Male (125). The Highest prevalence of DM in Female (33.33%), HTN in Male (48%) and both DM and HTN in Female (8.33%) as represented in Figure 2.

The present study revealed that the prevalence of HTN (45.96%) and DM (22.36%) in study population, so there is significantly *higher number* of *study* subjects who were *hypertensives* as represented in Table 2.

N.B. Chi square value = 0.614 significant at 5% level (p>0.05) D.F = 6.

Majority of the COPD cases were smokers (i.e. current smoker and ex-smoker). Among the patients having DM and/or HTN majority were smokers. It was seen that smokers were mostly associated with DM and/or HTN as shown in Table 4. Statistical analysis revealed that there is no significant association between smoking and DM and/or HTN.

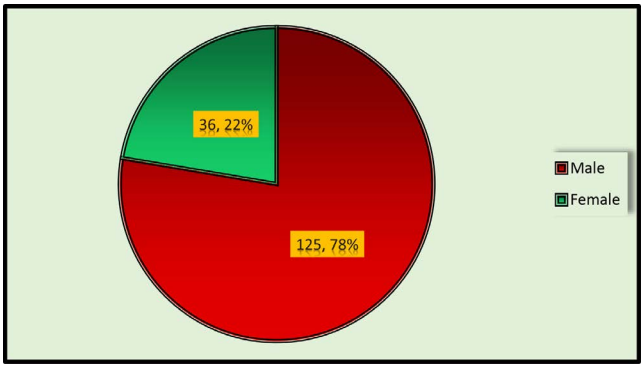

Figure 2. Sex wise distribution in study population.

Table 1. Age wise distribution of DM and/HTN in COPD cases of study population

Age group	No. of patients with DM (36)	No. of patients with HTN (74)	No. of patients with DM and HTN patients (12)	No. of patients without DM and/or HTN patients (39)	No. of patients (161)
40-50	2(25%)	4(50%)	0(0%)	2(25%)	8(4.9%)
51-59	7(14.28%)	18(36.73%)	3(6.12%)	21(42.85%)	49(30.34%)
60-69	18(28.12%)	33(51.56%)	5(7.81%)	8(12.5%)	64(39.7%)
>70	9(22.5%)	19(47.5%)	4(10%)	8(20%)	40(24.78%)
Total	36(22.36%)	74(45.96%)	12(7.45%)	39(24.22%)	161(100%)

Table 2. Prevalence of DM and/or HTN in COPD cases of study population

Component	No. of COPD cases	Percentage
HTN	74	45.96%
DM	36	22.36%
Without DM and/or HTN	39	22.44%
DM and HTN	12	7.45%
Total	161	100%

Table 3. Association of smoking with COPD

Smoking status	No. of patients with DM (36) (22.36%)	No. of patients with HTN (74) (45.96%)	No. of patients with DM and HTN patients (12) (7.45%)	No. of patients without DM and / or HTN patients (39) (24.22%)	No. of COPD cases
Current Smoker	10(21.73%)	23(50%)	2(4.34%)	11(23.9%)	46(28.57%)
Ex-Smoker	11(20%)	29(52.72%)	3(5.45%)	12(21.8%)	55(34.11%)
Non-Smoker	15(25%)	22(36.66%)	7(11.6%)	16(26.6%)	60(37.26%)
Total	36	74	12	39	161(100%)

Table 4. Association of DM and/or HTN in Global initiative for chronic obstructive lung disease staging of COPD cases

GOLD stages	With DM (36)	With HTN (74)	With DM and HTN (12)	Without DM and/ or HTN (39)	Total
I (Mild)	2 (5.55%)	3(4.05%)	1(8.33%)	2(5.12%)	8
II (Moderate)	5(13.88%)	11(14.86%)	3(25%)	7(17.94%)	26
III (Severe)	13(36.11%)	28(37.83%)	3(25%)	12(30.76%)	56
IV (Very Severe)	16(44.44%)	32(43.24%)	5(41.66%)	18(46.15%)	71
Total	36	74	12	39	161

N.B. Chi square value = 0.947 significant at 5% level ($p>0.05$) D.F = 9.

The study revealed that in all the four stages of COPD, highest number of HTN patients found in COPD cases. It was observed that among the cases presented in stage IV (71), DM, HTN and both DM and HTN were recorded in maximum no. of cases, whereas in patients of stage I (8) COPD least level were found. Increase association of DM and/or HTN increases with severity of obstruction as shown in Table 4. Statistical analysis revealed that there is no significant association between severity of COPD and DM and/or HTN.

5. Discussion

Co-morbidities in COPD contribute significantly to the overall severity and mortality of the patient. The present study "Prevalence of diabetes and hypertension and its association with Chronic Obstructive Pulmonary Diseases" was a hospital based cross sectional study constituting 161 COPD cases.

Prevalence of DM and /or HTN were recorded as 22.36% (36/161), 46% (74/161) and 7.45% (12/161) of COPD cases in the present study respectively. The prevalence of DM in our study is similar to the study of Ajit E. *et al.*[12] and Mahishale V. *et al.*[13] who reported 23.05% and 25.63% among COPD cases in their studies respectively. In contrast to our present study prevalence was 12.7% inMannino D.M. *et al.*[14] respectively.

Similarly the prevalence of HTN is similar to our study with Singh R.*et al.*[15] and Mannino D.M.*et al.*[14] who reported 38.7% and 52% among COPD cases in their study respectively.

In contrast to present study prevalence is 28% in Antonelli I. R. *et al.*[16] respectively.

According to Mannino D. M. *et al.*[14] increased prevalence of high BP and increased DM may be due to intake of oral steroid and ICS which augments the pathologic process.

The mean ± SD age of COPD patients was 62.92 ± 8.97 years. This was comparable with the results of Breyer *et al.*[17] and Park SK.*et al.*[18] who reported a mean age of 63.7 ± 7.1 and 62.06 ± 9.8 years, respectively. The present findings are not in line with that of Marquis *et al.*[19] who observed COPD in older patients i.e. 73.7 ± 8.3 years, respectively. These findings are due to fact that COPD is usually a disease of middle age and old age. Lower mean age was recorded in the studies of Ravikiran M. *et al.*[20] (42.7 ± 16.62years) and Ameen N. M. *et al.*[21] (56.6 ± 9.02 years). The mean lower age may be due to the selection

criteria as in case of Ravikiran M. *et al.*[20] which was a community based study.

Age wise prevalence of DM and HTN maximum in age group 60 to 69 years ie. 28.12% and 51.56% respectively.

The distribution of COPD according to sex (male:female) was reported as 3.5:1. Male cases outnumbered females.

Majority of the patients were in the age group of 60-69 years (64 cases) followed by 50-59 years (49 cases). The prevalence of COPD in females was 22.36%. Lesser number of female COPD patients may be due to the fact that majority of females in our country are nonsmokers, their outdoor exposure to dust particles is less and females usually report for their disease in late stage. DM and/or HTN were reported in 29(80.55%) female and 93(74.4%) male patients in the present study.

In our study sex wise prevalence of DM , HTN and both DM and HTN were 19.2% , 48% , 7.2% in male and 33.33%, 38.88%, 8.33% in Female respectively. Hence the HTN is predominant in males whereas DM is predominant in females.

Similar observations have been recorded by Mannino D. M. *et al.*[14] who found 13.5% of DM, 40.8% of HTN male in their study. However in male slightly higher percentage of DM and HTN were reported byAlmagro P.*et al.*[22] in their study i.e. 27.4% and 53%, respectively.

The present study is according to Almagro P. *et al.*[22] and Mannino D. M. *et al.*[16], who found 44.4% of DM and 39.2% of HTN in female respectively.

The present findings are not in line with that of Almagro P. *et al.*[22] who observed 70% of HTN in female.

Majority of the patients were smoker i.e. Current smoker (28.57%) or ex-smoker (34.11%). Being a smoker has been associated with higher risk of having DM and/or HTN. Studies have reported that smoking is considered to be one of the major causes of systemic inflammation in people with COPD[5] consequently; more patient education on the benefits of smoking cessation should be encouraged.

Similar observations have been recorded by Lam K. B. H. *et al.*[7] who found 47% non-smokers, 31.8% current smokers and 21.2% ex-smokers in their study.

However, Ameen N. M. *et al.*[21] found all the COPD patients to be smokers. This may be due to fact that all patients in his study were male. The present findings are not in line with Park SK *et al.*[18] who found 47.9% current smokers, 31.9% ex-smokers and 20% non-smokers in their study.

In our study prevalence of DM and/or HTN in Current smoker (21.73%, 50%, 4.34%) in Ex-smoker (20%, 52.72%, 5.45%) and in nonsmokers (25%, 36.66%, 11.66%) respectively.

Similar observations have been recorded by Cazziola M. *et al.*[23] who found 18.7% of DM in active smoker.

In contrast study by Mannino D. M.*et al.*[14] who found Prevalence of DM 13.5% in current smoker, 13.6% in ex-smokers, 11.5% in never smokers COPD cases in their study.

Present study similar with Mannino D. M.*et al.*[14] who reported 42.6%, 41.2% and 34.3% of HTN COPD cases in current smokers, ex-smokers and non smokers in their study respectively.

The distribution of COPD patients according to GOLD stages I-IV were 4.96%, 16.14%, 34.78% and 44.09%, respectively whereas DM and/or HTN were recorded in the GOLD stages I-IV as (5.55%, 4.05%, 8.33%), (13.88%, 14.86%, 25%), (36.11%, 37.83%, 25%) and (44.44%, 43.24%, 41.66%) respectively. Highest frequency of DM and/or HTN were observed in GOLD stage IV. There was an increasing trend in the association of DM and/or HTN COPD cases from stage I to stage IV.

The lower frequencies of DM and/or HTN were seen in stages I of COPD cases.

The present study is similar to the study of Bermudez G *et al.*[24], Mahishale V. *et al.*[13]. Lam KBH *et al.*[7] observed that the risk of DM and/or HTN increases with increasing severity of obstruction.

In contrast to present study Marquis *et al.*[19] and Apkinar *et al.*[25] found low frequency of DM and/or HTN in stage IV and found highest frequency of DM and/or HTN cases in GOLD stage II because a determinant of systemic inflammation in general population, was more frequent in stable COPD patients, especially in early stages (GOLD stage I-II) and which was not similar to our study.Further studies are necessary to clarify existing mechanisms for the relationship between DM and/or HTN and COPD.

So, association of DM and/or HTN COPD cases may or may not be directly related to severity of COPD. It depends upon the amount of systemic inflammation present at the time of stage of COPD. However, there is controversy regarding incidence in severe cases that have less incidence of DM and/or HTN.

6. Conclusion

- Prevalence of HTN was recorded more than DM and combined prevalence of DM and HTN was found to be lower than the individual DM and HTN respectively.
- DM and HTN were found to be more prevalent in severe and very severe COPD patients as compared to mild and moderate COPD cases.
- Sex wise prevalence of DM is higher in females than males whereas for HTN higher in males.
- To prevent DM and/or HTN related complication in COPD patients, the patients should be screened for DM and HTN at the time of diagnosis

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