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RESEARCH ARTICLE

Anemia as a comorbidity in chronic obstructive pulmonary disease - A hospital-based study in East Sikkim

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a chronic airway obstruction due to chronic inflammation. This entity is one of the major causes of premature mortality and morbidity in adults. Anemia is known to be a comorbidity in COPD as in many other chronic diseases. **Aims and Objectives:** The present study is a retrospective hospital-based study aimed to determine the prevalence of anemia in the study population of the state of East Sikkim. **Materials and Methods:** In this hospital-based retrospective study, 533 clinically diagnosed COPD patients were studied from the teaching hospital under Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim. 207 patients who fulfilled the inclusion criteria were analyzed. Anemia was defined as per the WHO criteria as hemoglobin (Hb) <13 g% in males and <12 g% in females and hematocrit (Hct) <39 in males and <36% in females. Statistical analysis was done using SPSS 23.0. **Results:** The mean age of COPD patients in this study was 68.17 years in males and 67.41 years in females. Of the 207 patients studied, 54 (26.1%) male had Hb <13 g% and 71 (34.3%) female had Hb <12 g%. The Hct level <39% was found in 53 males (25.6%) and <36% found in 71 (34.2%) females. **Conclusion:** The prevalence of anemia in males was 26.1%, and in females, it was 34.3% based on the Hb levels, and based on Hct values, it was 25.6% in males and 34.2% in females. Anemia was more prevalent in older age groups in both males and females.

KEY WORDS: Chronic Obstructive Pulmonary Disease; Anemia; Hemoglobin; Hematocrit

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic airway obstruction due to chronic inflammation of the airway leading to lung parenchymal destruction resulting in emphysema. This entity is one of the major causes of premature mortality and morbidity in adults and records the greatest proportion of mortality of all respiratory diseases.[1,2]

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By the year 2020, COPD is expected to be the third most frequent cause of mortality worldwide.[3] Apart from severe airway obstruction and a decrease in functional capacity, COPD has its association with various markers of systemic inflammation and multiple comorbidities.[4] COPD is considered as part of chronic systemic inflammatory disease process and is associated with raised inflammatory markers such as interleukin-1, interleukin-6, and tumor necrosis factor-α.[5,6] Comorbidities associated with COPD are because of its effect on the extrapulmonary organs. Weight loss, anxiety, depression, skeletal muscle dysfunction, atherosclerosis, coronary artery disease, osteoporosis, and higher rate of lung cancer are some of the principal comorbidities found in COPD patients.[4,7] Anemia is known to be a comorbidity in COPD as in many other chronic diseases. Although COPD leads to hypoxic hypoxia and polycythemia is a common

feature, anemia in COPD is reported to be about 13-33%.[8-11] Anemia with COPD requires frequent hospitalization that leads to health-care resources utilization and poor quality of life, especially in older age groups. The present study is a retrospective hospital-based study aimed to determine the prevalence of anemia in the study population of the state of Sikkim.

MATERIALS AND METHODS

After clearance from the Institutional Ethical Committee, we retrospectively retrieved data of clinically diagnosed COPD patients, who were attended to as outpatients in the Department of Medicine, from the Medical Records Department of the Teaching Hospital of the Medical College in the State of Sikkim for June 2011-June 2014 as per the ICD coding, and they were analyzed.

All patients with coexisting diseases such a bleeding disorders, any malignancy, thyroid disease, chronic liver disease, chronic kidney disease, heart failure, gastrointestinal bleed, abnormal uterine bleed, tuberculosis, collagen disease, diabetes mellitus, and major surgeries within the past 3 months were excluded from the study.

Anemia in the present study was defined as per the WHO criteria as (a) hemoglobin (Hb) <13 g% in males and 12 g% in females and (b) hematocrit (Hct) <39% in males and <36% in females. Diagnosis of COPD was based on the clinical diagnosis made by the treating physician.

A total of 533 records were retrieved, of which 207 records were finally included and analyzed in the study, and the rest were excluded because of either a coexisting disease condition as per exclusion criteria or because of incomplete documentation in the patient records.

Hospital number, name, age, sex, address, Hb level, red blood cell (RBC) count, and red cell indices (Hct, mean corpuscular volume [MCV], mean corpuscular hemoglobin [MCH], and MCH concentration [MCHC]) were noted and saved in a pro forma, and statistical analysis of the same was done using the SPSS Version 23.0 and Microsoft Excel 2013. Mean values were compared using ANOVA, and frequency comparison was performed by Chi-square test.

RESULTS

The present study included 207 clinically stable COPD patients. There were 131 (63%) female and 76 (37%) male patients with an age range of 21-95 years as summarized in Table 1.

The mean age of COPD patients in this study was 68.17 years in male and 67.41 years in females.

Table 1: Distribution of patients across all age groups

Age group	Females	Males	Total
21-30	1	5	6
31-40	3	2	5
41-50	14	3	17
51-60	13	12	25
61-70	42	14	56
71-80	37	24	61
81-90	15	14	29
≥91	6	2	8
Total	131	76	207

Of the 207 patients studied, 54 (26.1%) male had Hb <13 g% and 71 (34.3%) female had Hb <12 g%. The mean Hb in the anemic group was 10.68 g/dl (10.48 for females and 10.96 for males, $P = 0.050$). The mean Hb of the total population was 11.9 g/dl in males and 11.6 in females. The mean Hb of the total population was 11.7 g/dl.

Maximum male anemic patients (Hb <13) were in the age group of 71-80 (22, 10.6%) followed by 81-90 (13, 6.3%). The trend was not the same in female patients. Maximum female patients were anemic (Hb <12) in 71-80 age group (23, 11.1%) followed by 61-70 years (19, 9.2%) as shown in Table 2.

The Hct level <39% was found in 53 males (25.6%) and <36% found in 71 (34.2%) females. These patients were mostly in the age group of 71-80 (26, 12.56% females and 22, 10.62% males), followed by 81-90 for males (13, 6.28%) and 61-70 for females (16, 7.72%). The mean Hct of total population was 35.33 (35.16 of females and 35.63 of males) and of this subgroup (patients with <39 for males and <36 for females) was 31.93 (31.44 of females and 32.58 of males, $P = 0.112$).

Mean RBC count of the total population (all COPD patients) was 4.04×10^5 cells/cumm. Anemic patients had a mean RBC count of 3.72×10^5 cells/cu mm and non-anemic patients 4.5×10^5 cells/cu mm ($P < 0.001$).

Mean MCV was 86.86 in female patients and 88.39 in male patients (overall 87.42, $P = 0.213$). An MCV of <80 was present in female (7.2%) and male (2.9%) patients. Out of these 21 patients who had an MCV of <80, 13 patients were older than 60 years.

Female patients had a mean MCH 29.02 and male patients 29.64 ($P = 0.168$). The number of patients who had an MCH of <25 was 13 (6.3%), of these 7 patients were older than 60 years.

Mean MCHC values were 33.3 in females and 33.23 in male patients ($P = 0.799$). Anemic patients had a mean MCHC of

33.18 and non-anemics of 33.42 ($P = 0.407$). The comparisons are shown in Tables 3 and 4.

DISCUSSION

In our study, the mean age of COPD patients was 68.41 years in males and 67.41 in females. The prevalence of anemia from this study was estimated to be 26.1% in males and 34.3% in females according to the WHO criteria depending on Hb levels (Hb <13% in males and <12% in females). The prevalence of anemia in COPD patients in the previous studies has shown to vary from 10 to 15%.[12-15] However, in the study by John et al., the prevalence of anemia was estimated at 23.1%.[16] In another study by Halpen et al. from Medicare claims data, anemia was identified in 21% of COPD patients which is also less than our study. However, in both the studies, the prevalence was not specified separately for males and females which was estimated in the present study. In another study by Shorr et al., it was reported that the prevalence of anemia was 33% which was comparable to the prevalence of female population in our study.[17] The mean Hb levels in males was 10.96 g% and in females was 10.48 g%. This was mild anemia which is similar to the previous studies.[6,18,19] In our present study, anemia defined by Hct <39% in males and <36% in females. We found that anemia was present in 25.6% of males and 34.2% of females which is higher than the findings of Chambellan et al. where they reported that 13% of males and 8% females were anemic.[14] However, this contrast may be because they studied only the patients with severe O_2-dependent COPD patients. It has been observed that prevalence of anemia in general population increases with age irrespective of whether the population has COPD or any other chronic conditions.[20] However, in some other studies, it has been shown that aging is responsible for the greater prevalence of anemia in COPD patients.[17,18,21,22] Even in our study, the maximum male anemic patients were in the age group of 71-80 years (10.6%) followed by 81-90 years (6.3%). However, in the female anemic patients, the trend was slightly different. The maximum was found in the age group of 71-80 years (11.1%) followed by 61-70 years (9.2%).

Table 2: Patients of various indices across all age groups

Parameters	Age groups								Total
	21-30	31-40	41-50	51-60	61-70	71-80	81-90	≥91	
Females with Hb <12	0	1	8	8	19	23	9	3	71
Males with Hb <13	1	2	1	3	11	22	13	1	54
Total	1	3	9	11	30	45	22	4	125
Females with Hct <36	0	1	8	8	16	26	9	3	71
Males with Hct <39	1	2	1	3	11	22	13	0	53
Total	1	3	9	11	27	48	22	3	124
Patients with MCV <80	1	1	4	2	6	3	4	0	21
Patients with MCH <25	1	1	4	0	4	2	1	0	13

Hb: Hemoglobin, Hct: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin

Table 3: Comparison of means of various indices among anemic and non-anemic patients

Patient characteristics	Hb	RBC count (×10^5)	Hct	MCV	MCH	MCHC
Anemic patients (125)	10.689	3.7229	32.053	86.24	28.945	33.189
Non-anemic patients (82)	13.471	4.5321	40.346	89.22	29.827	33.423
Total (207)	11.791	4.0434	35.338	87.42	29.294	33.281
P	<0.001	<0.001	<0.001	0.013	0.024	0.407

Hb: Hemoglobin, RBC: Red blood cell, Hct: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration

Table 4: Comparison of means of male and female COPD patients

Patient characteristics	Hb	RBC count (×10^5)	Hct	MCV	MCH	MCHC
Females	11.696	4.0536	35.164	86.86	29.092	33.308
Males	11.954	4.0259	35.638	88.39	29.643	33.235
Total	11.791	4.0434	35.338	87.42	29.294	33.281
P	0.345	0.763	0.564	0.213	0.168	0.799

Hb: Hemoglobin, RBC: Red blood cell, Hct: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, COPD: Chronic obstructive pulmonary disease

Limitations of the Study

1. Spirometry was not done in all patients, so COPD diagnosis was only based on clinical findings and severity of COPD and its association with anemia could not be ascertained.
2. Levels of iron and Vitamin B_{12} were not estimated which could have added more light to the issue.
3. The study was conducted for 3 years, longer period with larger sample size with strict inclusion criteria to eliminate confounding factors could have thrown more light in the problem.

CONCLUSION

From our retrospective study of 207 COPD patients, we estimated the prevalence of anemia in males to be 26.1%, and in females, it was 34.3% based on the Hb levels, and based on Hct values, it was 25.6% in males and 34.2% in females (the WHO criteria). Further, we found that anemia was more prevalent in older age groups in both males and females. Since the study was conducted in the hilly state of Sikkim with patients residing in different altitudes, we still found the prevalence of anemia to be higher. Since anemia is shown as a major predictor of mortality in COPD patients, it should be addressed in routine practice so that the ill effects of O_2 deficiency due to anemia can be taken care of in patients with pulmonary dysfunction, thereby improving the quality of life. Robust prospective study with strict inclusion criteria eliminating the confounding factors will help the clinicians to understand better the pathophysiology of anemia in COPD patients and treat them, thus reducing morbidity and mortality.

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