Research Article **ISSN:2321-2624**

International Journal of Medicine and Pharmaceutical Research
www.pharmaresearchlibrary.com/ijmpr

Prevalence of Anaemia in COPD Patients of Jodhpur, Rajasthan, India

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Received: 28 July 2014, Accepted: 19 September 2014, Published Online: 10 October 2014

Abstract

Anaemia is commonly seen in COPD and increasingly being recognized as a risk factor associated with increased mortality. Occurrence and prevalence of anemia in COPD is less studied. The aim of the study was to investigate the prevalence of anemia in COPD patients. The present study was conducted on 50 normal healthy controls and 150 COPD patients selected from Pulmonary medicine Department of LN Rathi Memorial Hospital Jodhpur. Each one of them was subjected to PFT assessment and various hematological parameters to determine anemia status of patient e.g. Hb, Hct, MCV, MCH, S. Iron, TIBC and S. Ferritin. Data thus obtained were compared with controls by Student's t-test. Our results show that anemia is present in 44.67% patients. All PFT parameters were found to be significantly low [p-value < 0.0001] in anemic, nonanemic and overall COPD patients. Hb, Hct, MCV, MCH, S. Iron, and S. Ferritin values measured were very significantly low in anemic and overall patients but not in nonanemic patients. TIBC values show reverse trend i.e. high in anemics & all COPD patients but normal in nonanemics. This study indicates high prevalence of microcytic anemia in COPD patients.

Keywords: Anaemia, Pulmonary function test, Emphysema, Inflammatory response, Cigarette smoking, COPD.

Contents

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Manuscript ID: IJMPR2224

PAPER-QR CODE

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a highly prevalent disease. It is the fourth cause of death in developed countries and overall fifth in the world according to World Health Organization estimates. Chronic obstructive pulmonary disease (COPD) represents one of the most common respiratory diseases in clinical practice. It includes chronic bronchitis, emphysema, small airways disease and long standing asthma. COPD is a disease state characterized by chronic airflow obstruction that is not fully reversible and is due to the presence of specific

structural abnormalities of both the airways (bronchitis and bronchiolitis) and the pulmonary parenchyma (emphysema). It is currently accepted that an excessive inflammatory response of the lungs to a variety of noxious inhaled gases or particles mostly cigarette smoking [28, 29, 30] is a key in the pathogenesis of COPD [1]. COPD is a slowly progressive disease that is characterized by a decrease in the ability of the lungs to maintain the body's oxygen supply and remove carbon dioxide. As a result they become short of breath after minimal exertion. Anaemia, is common in COPD and is associated with higher co-morbidity, mortality and health costs [2]. Anaemia in COPD is increasingly being recognized as a risk factor associated with increased mortality [3]. The World Health Organization (WHO) defines anemia on the basis of hemoglobin level < 13gm% and haematocrit level <39% in males & hemoglobin < 12 gm% and Hct < 36% in females [4].

Development of anaemia in COPD may be due to smoking, malnutrition, and probably the systemic inflammation that accompanies COPD. The occurrence and prevalence of anaemia in COPD has rarely been studied. Anaemia is such a common and simple clinical finding that we may underestimate its physiological relevance in COPD. Inadequate hemoglobin levels could aggravate tissue hypoxia, worsen dyspnea, and limit exercise tolerance (5). Patients suffering from COPD show that the anaemia associated with this disease goes undiagnosed in most of the caases. Anaemia is seen in many chronic diseases such as heart failure, rheumatoid arthritis, cancer and chronic renal disease (6). It occurs relatively frequently in COPD patients and is related to the presence of inflammation; it is an understudied issue in COPD but may be of great importance in this disease [7].

Anaemia is, therefore, an entity that should be taken into consideration in the overall management of respiratory disease because it may have a clear detrimental impact on various aspects of the patient's health, including dyspnea, exercise tolerance, and quality of life. The aim of this study was to investigate the prevalence of anaemia in COPD patients.

2. Materials and Method

The present study was conducted under the Department of Physiology, Dr. S.N. Medical college and Department of Pulmonary Medicine of L. N. Rathi Memorial Hospital, Jodhpur. 50 normal healthy subjects were chosen on random basis from society which served as control group. 150 Non-tubercular Chronic Obstructive Pulmonary Disease (COPD) patients attending OPD of L. N. Rathi Memorial Hospital, Jodhpur were included in this study and labeled as test group.

Patients of test group were subjected to following investigations as per standard methods mentioned in parenthesis.

1. Pulmonary function tests: Respiratory parameters like FVC, FEV1, FEV1/ FVC, FEF 25-75% and Peak Expiratory Flow Rate were determined by Computerized Polygraph - Spiro Excel. COPD was diagnosed according to the guidelines of American Thoracic Society.
2. Hæmatological parameters - Hb, TRBC, Haematocrit value, MCV, MCH etc. were determined by Automatic Cell Counter.
3. S. Iron and TIBC were estimated by Ferrozine Method [Siedel, J. et.al. (1984) clin. chem. 30: 975].
4. S. Ferritin was measured by Chemiluminescence method.

Observations:

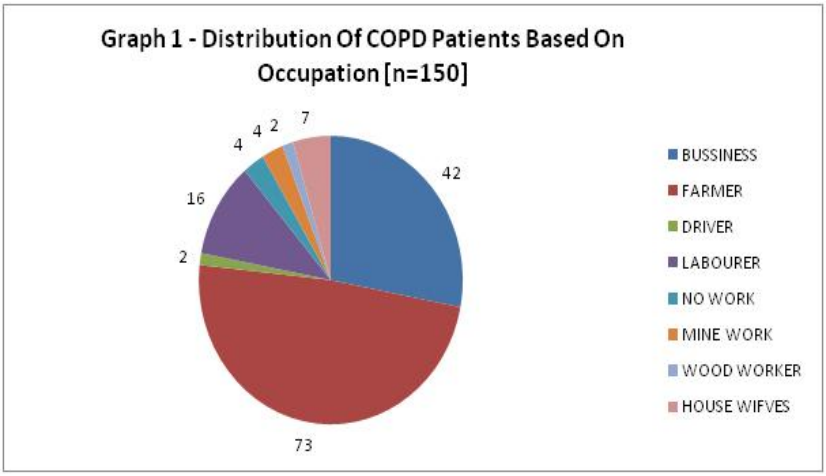

Figure 1

Table 1: Distribution of COPD patients according to their business

Occupation	Number	%
BUSSINESS	42	28
FARMER	80	53.33
DRIVER	2	1.3
LABOURER	16	10.6
NO WORK	4	2.6
MINE WORK	4	2.6
WOOD WORKER	2	1.3
Total	143	95.06

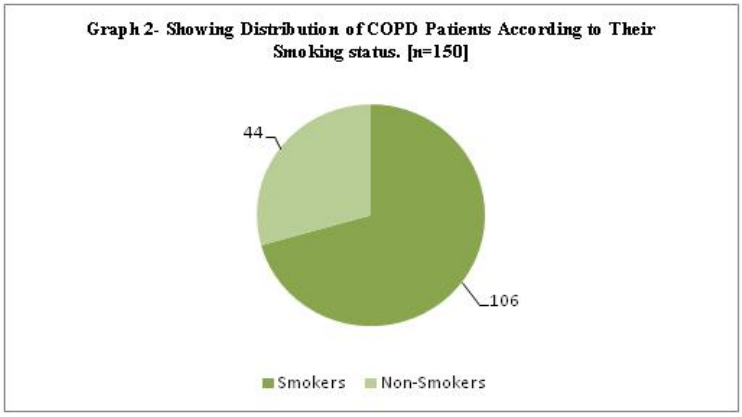

Figure 2

Table 2: Prevalence of COPD in smokers and nonsmokers.

Smoking	Number	%
Yes	106	70.66
No	44	29.33
Total	150	100

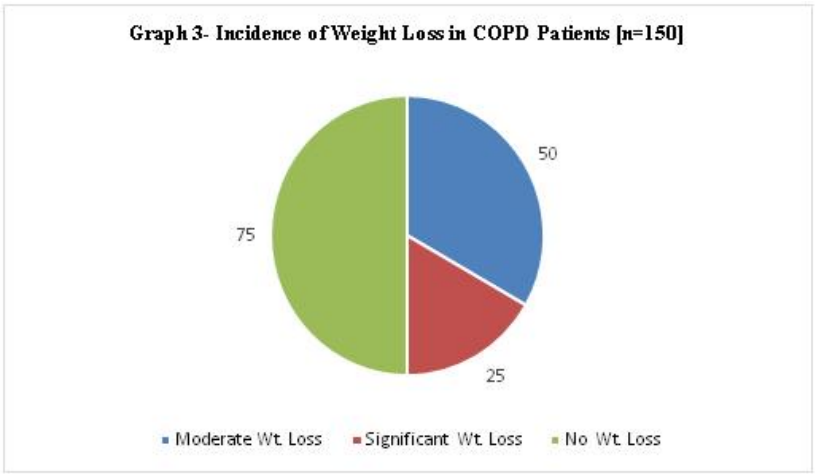

Figure 3

Table 3: Incidence of weight loss in COPD patients

Wt. Loss	Number	%
Yes Moderate	50	33.33
Yes Significant	25	16.66
No	75	50
Total	150	100

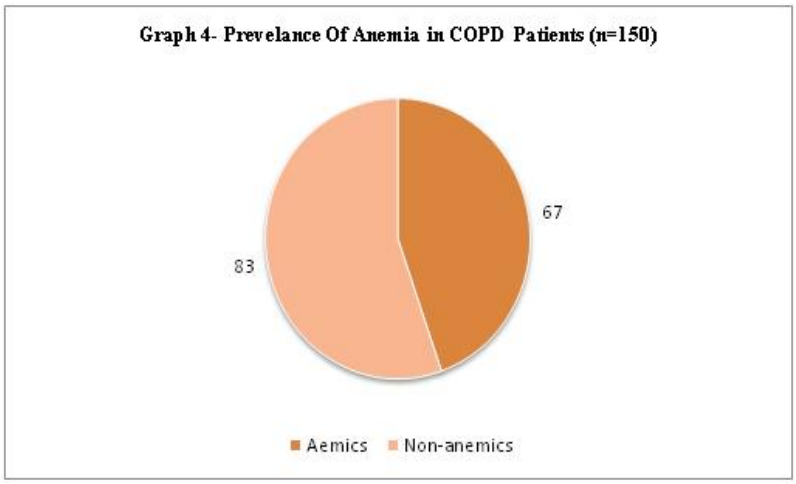

Figure 4

Table 4: Prevalence of anemia in COPD patients

	Number	**%**
Anemics	67	44.67
Non-anemics	83	53.33
Total	150	100

Table 5: Mean Values ± SD and p-values for Lung Function Tests [FVC, FEV1, FEV1/FVC, FEF 25-75% and PEFR in Normal Controls v/s Anemic, Non-anemic & All COPD Patients

Parameters	Group	Control v/s Anemic COPD Patients [n = 67]		Control v/s Non - Anemic COPD Patients [n = 83]		Control [n = 50] v/s All COPD Patients [n = 150]		Anemic [n = 67] v/s [Non - Anemic COPD Patients [n = 83]	
		Mean ± SD	p-Value	Mean ± SD	p-Value	Mean ± SD	p-Value	Mean ± SD	p-Value
FVC % pred	Control	77.144 ± 4.246	< 0.0001	77.144 ± 4.246	< 0.0001	77.144 ± 4.246	< 0.0001	62.235 ± 4.495	< 0.001
	COPD	62.235 ± 4.495		64.432 ± 3.85		63.45 ± 4.279		64.432 ± 3.85	
FEV 1 % pred	Control	68.06 ±5.973	< 0.0001	68.06 ± 5.973	< 0.0001	68.06 ±5.973	< 0.0001	48.739 ± 3.335	< 0.0001
	COPD	48.739 ± 3.335		53.109 ± 3.276		51.157 ± 3.947		53.109 ± 3.276	
FEV 1/FVC % pred	Control	93.455 ±7.503	< 0.0001	93.455 ±7.503	< 0.0001	93.455 ±7.503	< 0.0001	80.086 ± 7.226	< 0.002
	COPD	80.086 ± 7.226		83.996 ± 8.288		82.25 ± 8.046		83.996 ± 8.288	
FEF 25-75% % pred	Control	83.515 ± 8.314	< 0.0001	83.515 ± 8.314	< 0.0001	83.515 ± 8.314	< 0.0001	42.095 ± 8.797	< 0.0001
	COPD	42.095 ± 8.797		50.965 ± 6.346		47.003 ± 8.719		50.965 ± 6.346	
PEFR % pred	Control	78.094 ± 5.486	< 0.0001	78.094 ± 5.486	< 0.0001	78.094 ± 5.486	< 0.0001	43.939 ± 9.33	< 0.0001
	COPD	43.939 ± 9.33		48.957 ± 8.086		46.715 ± 8.989		48.957 ± 8.086	

Table 6: Mean Values ± SD and p-values for Hb, Hct, MCV, MCH, S. Iron, TIBC and S. Ferritin in Normal Controls v/s Anemic, Non-anemic & All COPD Patients

Parameters	**Group**	**Control v/s Anemic COPD Patients [n = 67]**		**Control v/s Non - Anemic COPD Patients [n = 83]**		**Control [n = 50] v/s All COPD Patients [n = 150]**	
		Mean ± SD	**p-Value**	**Mean ± SD**	**p-Value**	**Mean ± SD**	**p-Value**
HbGm%	Control	14.84 ±0.892	< 0.0001	14.84 ±0.892		14.84 ±0.892	
	COPD	10.791 ±1.354		14.39 ± 1.129	0.02	12.786 ± 2.179	< 0.0001
Hct in %	Control	40.852 ±13.246	< 0.0001	40.852±13.246		40.852 ±13.246	
	COPD	32.853 ±3.697		42.12 ± 2.913	0.401	37.982±5.666	0.033
MCV in fl	Control	86 ±2.157	< 0.0001	86 ±2.157		86 ±2.157	
	COPD	76.792 ±6.595		86.114 ± 4.842	0.879	81.95±7.334	0.0001
MCH in pg	Control	29.63 ±1.179	< 0.0001	29.63 ±1.179		29.63 ±1.179	
	COPD	24.273 ±2.9		29.45 ± 1.826	>0.999	27.138±3.497	< 0.0001
S. Iron Mg/dl	Control	103.02 ±12.626	< 0.0001	103.02 ±12.626		103.02 ±12.629	
	COPD	51.61 ±32.682		105.71±21.53	0.55	81.546±38.164	< 0.0001
TIBC µg/dl	Control	385 ±11.261	< 0.0002	385 ±11.261	0.46	385 ±11.261	0.01
	COPD	451.703 ±125.832		389 ± 37.8		416.98±93.707	
S. Ferritin ng/ml	Control	184.87 ±11.675		184.87 ±11.675		184.87 ±11.675	
	COPD	136.787±58.763	0.0001	157.3±105.4	0.067	148.145±131.867	< 0.0001

Statistical Analysis

Results were analysed by using open epi software for student`s t-test. P-value < 0.05 was considered significant.

3. Results and Discussion

Results

Among the 150 COPD patients studied all were males with mean age 53.54 ± 13.31. Most of them were farmers [53.33%], small grocers [28%] and laborers [10.67%]. Rest of the patients [8%] were drivers, miners, carpenters etc. [Table - 1]. Out of 150 patients 106 (70.67%) were smokers and rest were 44 (29.33%) nonsmokers. [Table - 2] When asked about weight loss, 50 patients (33.33%) reported moderate, 25 (16.66%) reported significant weight loss and 75 (50%) patients did not report any weight loss. [Table - 3]. According to WHO's definition of anemia Hb values < 13 gm% in males and 12 gm% in females were used to categorize COPD patients into anemics and non-anemics. In our study on 150 patients, we found 67 (44.67%) anemic patients and 83 (53.33%) non-anemic patients. [Table - 4]

Table - 5 shows comparison among various parameters of pulmonary function tests observed in controls, anemics, non-anemics and all COPD patients. PFT parameters recorded in above mentioned four groups were FVC, FEV1, FEV1/FVC, FEF 25-75% and PEFR. On comparison of these PFT data between Control subjects and three types of patient groups i.e. anemic, non-anemic and all COPD patients we found highly significant fall in all parameters. [p-values < 0.0001 in control v/s anemic, control v/s nonanemic and control v/s all COPD patients]. On comparing PFT parameters of anemic with nonanemics again we found highly significant fall in PFT values in anemics [p-values < 0.0001].

We also recorded hematologic parameters of COPD patients for determining anemia, like Hb, Hæmatocrit value, MCV, MCH, S. Iron and S. Ferritin. Results of these parameters observed in anemic, nonanemic and all COPD patients were compared with results found in control subjects. We found that results of all parameters in anemic and all COPD patients were highly significant [p-value < 0.0001]. TIBC shows reverse results in comparison to other parameters. In control v/s non-anemic COPD patient's results of Hb, Hct, MCV and MCH were not significant. But S. Iron, TIBC and S. Ferritin values were highly significant [Table -6].

Discussion

Anemia occurs relatively frequently in COPD patients and is related to the presence of inflammation. Considering its frequent presence in COPD patients it is still less studied but important issue in this disease. In our study, anemia as per WHO definition [with Hemoglobin conc. < 12 g/dl in women and <13.5g/dl in women] was present in as many as 44.67% of all COPD patients. Deficiency in vitamin B12, folate or iron can coexist with COPD and should not be overlooked in anaemia of COPD patients. Our results may be an overestimation of the anaemia prevalence, as we did not exclude patients with anemia related to nutritional deficiency. We excluded only pathological causes of

anaemia like gastrointestinal bleeding, chronic renal failure and other chronic disorders. As per guidelines of National Family Health Survey [NFHS-III] India [8], prevalence of anaemia in men of Rajasthan State was found to be 23.6%. If we deduct this figure of 23.6% from 44.67% observed by us, then anaemia due only to COPD may be arrived at and it was found to be 21.07%. Dolores Pancirov et al 2009 [9] found in their study on a group of COPD patients that anaemia (decreased hematocrit and hemoglobin values, increased proportion of reticulocytes, lower MCH and MCHC values along with normal or decreased MCV values) were present in 36 (24%) patients. The anemia found in the group of COPD patients was mainly normocytic and normochromic. M. Urban et al 2011 reported that about about half of the COPD patients were suffering from iron deficiency anemia [10].

Portillo K 2007 and associates [11] determined the prevalence of anemia in individuals diagnosed with COPD in a tertiary hospital over one year. They found that 56 [31%] COPD patients were anemic out of the total 177 cases. Frank Y et al 2012 [12] reported 24% anemic among all studied COPD patients. Similarly Similowski T 2006, Cote 2007, Michael T Halpern 2006, Gokul Krishnan 2006, Stanbrook MB 2003, Park MM 2003, John M 2005 and Davood Attaran 2009 found prevalence of anemia in COPD patients 10-15%, 17.1%, 21%, 7.5%, 36%, 48%, 13% and 16% respectively [13-20]. On the contrary Argirios E. et al 2004 [21] found significant elevation in various hematologic parameters like Hb, Hct, MCV and MCHC in hypoxemic COPD patients but they were unable to find any correlation macrocytosis and hypoxemia or erythrocytosis and red cell size. In this study we found microcytic hypochromic anemia as is evident by hematologic parameters, with highly significant low levels of S. Iron, S. Ferritin and high TIBC in anemic and overall COPD patients. In nonanemic patients no significant deviation from control levels was observed in either hematologic parameters or in S. Iron, S. Ferritin and TIBC.

Besides its effect on lung function, the chronic impairment of the respiratory system due to COPD has long term multi-organ consequences on the bone and liver metabolism, heart and cardiovascular system, brain, kidney, and skeletal muscles [28,29,30)]. Many chronic diseases have been shown to affect hematopoiesis, and also COPD may be associated to this kind of disorder. Mechanism of development of anemia in COPD might be similar to that in other chronic disorders. Increased levels of inflammatory cytokines i.e. IL1, IL6, and TNFα, may lead to shortened survival of red blood cells [22,23]. These findings are very common in COPD and exaggerated during its exacerbations [24]. Inflammatory cytokines also decrease the EPO response to hypoxemia, impede iron utilization, and impair bone marrow erythropoietin (EPO) response.

This is caused by a relative EPO resistance due to an impaired ability of red blood cell progenitors to respond to EPO [25-27]. The present study aimed to assess the type and distribution of anemia in COPD patients. Limitations of our study were - (i). We used 50 controls and 150 COPD patients. Looking to the vast population of Jodhpur city this sample size is too small to apply results thus obtained on whole population. Further investigation on large sample size is needed. (ii) Assessment of other parameters like EPO, S. Folate, S. Vit $B_{12,}$ and Inflammatory Cytokines should have done to establish their link with anemia in COPD patients.

4. Conclusion

Results of our study showed that iron deficiency anemia was prevalent in COPD patients. Clinicians should keep this fact in mind and appropriate measures should simultaneously be taken to diagnose and treat anemia while treating COPD.

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