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Original Research Article

Detection of Iron Deficiency Anaemia in Chronic Obstructive Pulmonary Disease Patients and the Effects of Iron Supplementation

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Abstract: ***Introduction:*** Chronic Obstructive Pulmonary Disease-induced chronic inflammation may cause or aggravate co-morbid conditions. Anaemia is a significant comorbidity. ***Aim of this study:*** This study aims to diagnose iron-deficiency anaemia in COPD patients and assess the benefits of iron supplementation. ***Material & Methods:*** This was an 18-month interventional trial undertaken in the general medicine department of a tertiary care teaching hospital. The systematic process was followed to get the institutional ethics committee's approval. ***Results:*** The study population averaged 51.32 years. Most patients (68%) were between 51 and 60 years old. Out of 150 individuals, 29% had anaemia, and 121% were non-anaemic. ***Conclusion:*** Anaemia and iron deficiency are significant comorbidities in patients with chronic obstructive pulmonary disease (COPD), according to the Indian Journal of Clinical Pharmacology and Biomarkers (JPCB) published in 2012.
Keywords: COPD, JPCB, Iron Deficiency Anemia, Iron supplementation.

INTRODUCTION

Chronic Obstructive Pulmonary Disease is a common, manageable disorder characterised by chronic respiratory symptoms and restricted airflow owing to airway and alveolar abnormalities. Inflammatory airway and alveolar abnormalities produced by exposure to toxic particles or gases cause chronic obstructive pulmonary disease. Exacerbations and comorbidities influence severity [1].

Chronic Obstructive Pulmonary Disease is the third leading cause of mortality in 2020. Chronic Obstructive Pulmonary Disease-induced chronic inflammation may cause or aggravate co-morbid conditions. Anaemia is significant comorbidity. With decreased exercise capacity and increased functional dyspnea, low haemoglobin levels in Chronic Obstructive Pulmonary Disease patients are closely related to decrease available ability and reduced quality of life [2].

Anaemia becomes increasingly frequent with age, and anaemia of inflammation, also known as anaemia of chronic illness, occurs in many chronic disorders. An inflammatory chronic disease that mostly affects the elderly. There may be inadequate data indicating Hb distribution and its influence on outcomes in the COPD population. Polycythemia, long considered a major consequence of COPD, is now rare [3].

Conversely, recent research shows that anaemia in COPD patients is shared and linked to increased mortality [4, 5]. Anaemia is a prevalent clinical finding that may overlook its physiologic significance in COPD [6].

The frequency of polycythemia is lower than an anaemia in chronic obstructive lung disease, according to a 2007 European Respiratory Journal research by C. Cote (n=683) [7].

Anaemia is an entity that should be included in the overall therapy of respiratory illness since it may negatively affect dyspnea, exercise tolerance, the effort of breathing, and quality of life.

We studied anaemia in COPD at a tertiary care hospital in Jaipur. This study aims to diagnose iron-deficiency anaemia in COPD patients and assess the benefits of iron supplementation.

MATERIAL AND METHODS

This was an 18-month interventional trial undertaken in the general medicine department of a

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tertiary care teaching hospital. The systematic process was followed to get the institutional ethics committee's approval. All patients gave informed permission.

PATIENT SELECTION CRITERIA

Inclusion Criteria
- Both Gender
- Patients with age 40 years and above are suggestive of COPD.
- All patients with clinical - radiological findings suggestive of COPD.
- Willing to participate in the study.

Exclusion Criteria
- Severe systemic disease.
- History of malignancy
- Renal failure
- Heart failure
- Bronchial asthma
- Recent history of blood transfusion
- Immunosuppressed & HIV positive patients.
- Patients who were unable to perform spirometry.
- Drop out cases during the study.

Procedure: All patients over 40 years of age who presented with dyspnea, persistent cough, and/or sputum production were evaluated for COPD. COPD patients' functional status was assessed using the BODE Index. Total iron studies include serum ferritin levels in COPD patients with low haemoglobin. The kind of anaemia was determined by serum iron levels and peripheral smear appearance. Using a universal sampling procedure, samples were collected.

The 150 patients had COPD. COPD patients with haemoglobin less than 13 g/dL and hematocrit less than 42 for males and 12 g/dL and less than 35 for females. Guidelines for iron insufficiency Anaemia in COPD patients: Peripheral smear with microcytic and hypochromic RBC. Reduce serum iron (30 micromol/L) Ferritin (15 microgram/l) Increase TIBC (>360 g/dL) 4.6 – 18.7 ng/mL normal serum folic acid.

RESULTS

During 18 months, 150 COPD patients were evaluated in a tertiary care hospital in northern India. 29 out of 150 patients were anaemic. There were 12 men and 17 women among the 29 anaemic COPD patients. Our research included participants aged 40-70. Our research found that anaemia affected more women than men with COPD.

Table-1: Study Population Characteristics

Parameter	Mean	Standard Deviation
Age	51.32 yrs	5.85
Weight	55.1 kg	11.1
Height	1.60 m	0.07
Body Mass Index (BMI)	21.40	3.56
FEV1	65.6%	15.52

The study population averaged 51.32 years. Most patients (68%) were between 51 and 60 years old. Out of 150 individuals, 29% had anaemia, and 121% were non-anaemic.

Table-2: Distribution of Age group

Age group	Number	Frequency
40-50	49	32.66 %
51-60	72	48.00 %
61-70	29	19.33 %

The degree of airway blockage differed across age groups but was not statistically significant. Patients with severe airway blockage had a lower BMI than those with mild or moderate obstruction. It was not statistically significant between the first two groups (mild and moderate blockage).

Anaemia is a chronic condition that is often connected with COPD. Anaemia affects 7.5-33% of COPD patients. COPD-induced systemic inflammation drives ACD. Anaemia was found to be 19.33 per cent in our research.

Table-3: Association among study group between Study group and sex

Study group		Sex		Total
		Male	Female	
Anaemic	Number	12	17	**29**
	Frequency	41.37%	58.62%	**100.00%**
Non-anaemic	Number	88	33	**121**
	Frequency	72.72%	27.27%	**100.00%**

The difference between pre-and post-treatment haemoglobin and serum ferritin levels of 9.0 g/dl and 76.03 ng/ml1 (p-value 0.0001) is significant. Iron supplementation enhanced haemoglobin in patients.

DISCUSSION

The current investigation revealed some pertinent findings. Anaemia has not been explored in COPD. Anaemia in COPD patients varies from 7.5% to 33%, depending on the demographic [8]. Anaemia is a prevalent clinical co-morbidity in COPD. Many unknown causes of anaemia exist [9, 10]. Since the health condition of COPD patients at various disease stages varies, it is reasonable to predict that these estimations will go significantly amongst patient groups [11].

Iron deficiency is a setting in different COPD processes. Its principal role is in inflammation [12]. The anaemia mechanism is based on current understanding. COPD patients with anaemia have altered pathways due to inflammatory indicators [13].

Regardless of anaemia, the identification of iron insufficiency in COPD patient's remains understudied [14]. AGE: The study population averaged 51.32 years (Table 1). Soler *et al*. 4 found a comparable age of 55. The participants in this research ranged in age from 41 to 70 (Table 2). This was selected since the FEV1 decreases with ageing. Patients were chosen from a specific age range to establish a homogeneous research group. During the trial period, no patient died. Table 3 displays the research group distribution by sex. Anaemia is more prevalent in female patients; however, this difference is not statistically significant. Comparative research by Roshanak Hasheminasab Zavarreh, MD, Mohammad-Mehdi Zahmatkesh found that anaemia occurs in 70% of men and 30% of females [15].

In our research, anaemia is associated with lower FEV1 and elevated BODE index, suggesting a probable relationship between Hb and functional status [16].

Research by C.Cote, M.D. Zilberberg and S. H. Mody found that anaemia patients' dyspnea and functional status varied considerably from non-anaemia patients. The severity of illness is connected with haemoglobin level in anaemic COPD patients.

COPD patients' haemoglobin levels drop, influencing spirometry severity (FEV1 value). In research by Roshanak Hasheminasab Zavareh, MD, Mohammad-Mehdi Zahmatkesh, anaemia and COPD severity were not related. As a result of systemic inflammation playing a pivotal role in COPD, our research found that anaemia is most common in COPD patients [17].

COPD fulfils the criteria of a chronic, inflammatory, multisystem disease leading to the expectation of anaemia. While anaemia in chronic heart failure or renal insufficiency has been frequently investigated, it is understudied in COPD. In our research, 44 percent of anaemic COPD patients have chronic illness anaemia, 41.8 percent have iron deficiency anaemia, and 13% have mixed anaemia. We discovered no statistically significant association between haemoglobin and BMI, age, or sex. COPD-induced systemic inflammation drives ACD.

Anaemia in COPD patients ranged from 7.5% to 33% in our research. COPD-induced systemic inflammation drives ACD. Anaemia was found to be 19.33 percent in our research. There was a substantial difference between the pre-and post-treatment haemoglobin and serum ferritin levels (p-value 0.0001). Iron supplementation enhanced haemoglobin in patients. Further prospective studies are required to determine the optimal therapy threshold for COPD patients and the impact of haemoglobin improvement on clinical outcomes.

CONCLUSION

Given the prevalence of COPD, anaemia and iron deficiency are significant comorbidities in COPD patients with known deleterious impacts on overall morbidity, mortality, and quality of life. Anaemia is common among COPD patients and is linked to poor clinical and functional outcomes. Anaemia and iron deficiency should be better diagnosed, treated, and prevented in COPD patients. The real frequency of anaemia in COPD patients are uncertain and vary on the populations studied and the testing methods used. Extrapulmonary symptoms of COPD are currently being given more attention, and treating these anomalies may reduce overall mortality. There is no link between haemoglobin and BMI, age, or sex. Chronic anaemia is more frequent than iron deficiency anaemia in COPD patients. The most common condition in India is anaemia, which reduces minute ventilation and labour of breathing in COPD patients. These people should be treated the same as other patients with similar illnesses. More research is needed to determine the efficacy of anaemia/iron deficiency therapy options in COPD patients, in order to provide more precise treatment recommendations. Anaemia should be considered in normal clinical practice among COPD patients to diagnose and treat if required. Complete iron testing is advised to assess anaemia in COPD patients. Other anaemia reasons must be checked out. Anaemia therapy for COPD patients is advised. A future prospective study will be required to determine the optimum treatment threshold and the impact of improved haemoglobin on clinical outcomes.

REFERENCES

1. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. 2011 Available from: Global Initiative for Chronic Obstructive lung Disease (GOLD).
2. Barnes, P. J., & Celli, B. R. (2009). Systemic manifestations and comorbidities of COPD. *European respiratory journal*, *33*(5), 1165-1185.
3. Zielinski, J. (1999). Effects of long-term oxygen therapy in patients with chronic obstructive pulmonary disease. *Current opinion in pulmonary medicine*, *5*(2), 81.
4. John, M., Hoernig, S., Doehner, W., Okonko, D. D., Witt, C., & Anker, S. D. (2005). Anemia and inflammation in COPD. *Chest*, *127*(3), 825-829.
5. Chambellan, A., Chailleux, E., & Similowski, T. (2005). Prognostic value of the hematocrit in patients with severe COPD receiving long-term oxygen therapy. *Chest*, *128*(3), 1201-1208.
6. John, M., Hoernig, S., Doehner, W., Okonko, D. D., Witt, C., & Anker, S. D. (2005). Anemia and inflammation in COPD. *Chest*, *127*(3), 825-829.
7. Cote, C., Zilberberg, M. D., Mody, S. H., Dordelly, L. J., & Celli, B. (2007). Haemoglobin level and its clinical impact in a cohort of patients with COPD. *European Respiratory Journal*, *29*(5), 923-929.
8. Weiss, G., Goodnough, L.T. (2005). Anaemia of chronic disease. *N Engl J Med, 352*; 1011–1023.
9. Hinshaw, H.C., Garland, L.H. (1956). Disease of the chest. Philadelphia: WB Saunders.
10. Jindal, S. K. (2012). COPD: The Unrecognised Epidemic in India. JAPI 60 February 2012 http://www.who.int/mediacentre/factsheets/fs315/en ; 2012
11. Challand, G. S., Michaeloudis, A., Watfa, R. R., Coles, S. J., & Macklin, J. L. (1990). Distribution of haemoglobin in patients presenting to their general practitioner, and its correlation with serum ferritin. *Annals of clinical biochemistry*, *27*(1), 15-20.
12. Hogg, J. C. (2004). Pathophysiology of airflow limitation in chronic obstructive pulmonary disease. *The Lancet*, *364*(9435), 709-721.
13. Norris, G.W., Landis, H.R.M. (1918). Diseases of the chest and the principles of physical diagnosis. Philadelphia: WB Saunders.
14. Badham, C. (1814). *An Essay on Bronchitis: With a Supplement Containing Remarks on Simple Pulmonary Abscess, Etc*. Callow.
15. Means Jr, R. T. (1999). Advances in the anemia of chronic disease. *International journal of hematology*, *70*(1), 7-12.
16. Courtney, M. E., Greene, H. L., Folk, C. C., Helinek, G. L., & Dmitruk, A. (1982). Rapidly declining serum albumin values in newly hospitalized patients: prevalence, severity, and contributory factors. *Journal of Parenteral and Enteral Nutrition*, *6*(2), 143-145.
17. Moffatt, R. J., Sady, S. P., & Owen, G. M. (1980). Height, weight and skinfold thickness of Michigan adults. *American Journal of Public Health*, *70*(12), 1290-1292.