Content available at: iponlinejournal.com

IP Indian Journal of Immunology and Respiratory Medicine

Journal homepage: www.innovativepublication.com

Original Research Article

A study of polycythaemia and associated factors in COPD patients attending a tertiary care hospital

Veerabhadrappa K. Kuppast[1], H B Chandrashekar[2], Umesh Y Ramadurg[3,*]

[1]*Dept. of of Respiratory Medicine, S Nijalingappa Medical College and HSK Hospital & RC, Bagalkot, Karnataka, India*
[2]*Dept. of Pulmonary Medicine, Bhagwan Mahaveer Jain Hospital, Bangalore, Karnataka, India*
[3]*Dept. of Community Medicine, S Nijalingappa Medical College and HSK Hospital & RC, Bagalkot, Karnataka, India*

ARTICLE INFO

Article history:
Received 13-03-2020
Accepted 25-03-2020
Available online 15-06-2020

Keywords:
Polycythaemia
Anaemia
COPD
tertiary care hospital

ABSTRACT

Background: Prevalence of polycythaemia amongst patients with COPD and its long term effects are unknown. There is limited information in the current literature describing the distribution of haemoglobin (Hb) and its impact on outcomes in the COPD population. The purpose of the present study was to determine the prevalence of polycythaemia in patients with COPD attending a pulmonary clinic, as well as to explore the associations between Hb levels and clinical outcomes.
Materials and Methods: A case series descriptive study was conducted on 50 patients of COPD attending pulmonary OPD of a tertiary care hospital.
Results: All subjects were male and were aged between 40-85 years. Mean age among of COPD patients with anaemia was 62.00± 10.37yrs and with polycythaemia was 62.86 ±9.03yrs. Amongst COPD patients with polycythaemia mean BMI was 18.49 ±3.78. Severity of smoking pack years among the patient group was maximum of 60 pack years and minimum of 20 pack years. Mean value of PCV among patients with polycythaemia and without polycythaemia were 56.29±2.87 and 41.09 ± 4.18 respectively.
Conclusions: Polycythaemia did not seem to be related with either increased COPD severity or with altered outcomes.

1. Introduction

COPD is a one of the major causes of health care burden worldwide and it is contributing to the mortality rates because of its increasing in prevalence[1]. Globally, the upsurge of COPD is placing the disease at 3rd position as the reason of mortality and at 5th place as the reason of loss of disability adjusted life years (DALY'S) by 2020. Polycythaemia is defined as Hemoglobin (Hb) >17 g/dl in men and > 15 g/dl in women. Or haematocrit >50% in men and > 45% in woman. Literature states that polycythaemia is seen in COPD patients. But the real prevalence of polycythaemia amongst patients with COPD & its long term effects are unknown. The production of erythrocytes from erythroid progenitors in the bone marrow is regulated in part by erythropoietin, synthesis of which is generally believed to be stimulated by hypoxia. In the case of Altitude-induced hypoxia, the red blood cell (RBC) mass is inversely proportional to the arterial oxygen saturation, while in chronic obstructive pulmonary disease (COPD), such a relationship is most variable.

There is incomplete information in the existing literature describing the distribution of hemoglobin (Hb) and its effect on outcomes in the patients with COPD. Usually polycythaemia, is understood to be highly prevalent in COPD patients, because of excess care given for correction of hypoxia nowadays, its frequency of occurrence is decreasing. But it is found in latest reports that increased mortality in anaemia patients with COPD is vastly prevalent[2]. Although the relation between anaemia and dyspnea is well known, the involvement of decreased Hb concentration to breathlessness and other clinical indices

* *Corresponding author*.
E-mail address: umeshramadurg79@gmail.com (U. Y. Ramadurg).

https://doi.org/10.18231/j.ijirm.2020.038

in patients with COPD is less understood. The purpose of the present study was to assesses the prevalence of polycythaemia in patients with COPD attending a pulmonary clinic, and the find relations between Hb levels and clinical outcomes.

2. Materials and Methods

A descriptive case series study was conducted in a Bhagwan Mahaveer Jain Hospital, Bangalore a tertiary care centre. All patients attending the respiratory medicine and general medicine OPD were included in the study after attaining informed consent. The study was conducted for a period of 2 years i.e., between July 2016 and June 2018. Socio demographic, personal history and symptoms were collected by using a pretested questioner. Clinical examination was done to assess the disease. Chest X-ray and Pulmonary function test were done to assess the disease progression.

3. Results

50 patients of COPD were included for the study. All study participants were male and were aged between 40-85 years. Based on the haemoglobin percentage study subjects were categorised into three groups. In patient group 36% (18) had anemia,14%(7) had polycythaemia.

Mean age among of COPD patients with anaemia was 62.00± 10.37yrs and polycythaemia was 62.86 ±9.03yrs. COPD patients with polycythaemia had a mean BMI of 18.49 ±3.78. Maximum of 60 pack years and minimum of 20 pack years was the severity of smoking pack years observed in the study population. 53.43±6.90 pack years and 32.74±8.23 pack years are the mean pack years of smoking among patients with polycythaemia and without polycythaemia respectively (p value= <0.0001).

42 % of the COPD patients had history of symptoms for 6 to 10 years. The mean years of symptoms among patients with polycythaemia and without polycythaemia was 12.86±2.85 years and 10.37±4.77 years are respectively. The difference in the durations of symptoms was not statistically significant.

On examination of the chest X ray of COPD patients with polycythaemia (n=7) 1 person had features of increased bronchovascular markings, 4 had features of Emphysema and 2 had normal chest X-ray. The pulmonary function revealed that among COPD patients with polycythaemia (n=7) 4 had moderate airway obstruction, 1 had severe airway obstruction and 2 had very severe airway obstruction.

The study revealed that among COPD with polycythaemia 1 subject did not had any co morbid conditions, 1 had DM alone, 2 had Hypertension alone and 3 subjects had both DM &Hypertension.

Mean value of PCV among patients with polycythaemia and without polycythaemia were 56.29±2.87 and 41.09±4.18 respectively and the difference was statistically significant. Mean value of MCV, MCH, MCHC (75.92± 2.62, 24.26± 0.66, 31.99± 1.34), (88.99± 18.49, 27.37± 3.52, 31.29± 3.21) among patients with polycythaemia and without polycythaemia respectively. (One-way ANOVA test for non-parametric variation, the p value= 0.0088, 0.0211, 0.4703 for MCV, MCH, MCHC respectively). The mean value of ESR was found to 23.43± 27.85 among patients with polycythaemia and 41.56±29.42 among patients without polycythaemia the difference observed was statistically significant.

4. Discussion

In the current study, 14% (7) of the study subjects had polycythaemia and anaemia was prevalent among 36% (18) patients with COPD(n=50). The causes for polycythaemia are increase in the total number of red cells in the body (true Polycythaemia) or due to drop in plasma volume relative to the volume of red cells (spurious or relative Polycythaemia). Primary disorder of hematopoietic tissue may lead to True Polycythaemia which produces excessive number of red cells(Polycythaemia Vera), it is a clonal disorder including a multipotent hematopoietic progenitor cell in which there is addition of phenotypically normal red cells, granulocytes, and platelets in lack of a obvious physiologic stimulus Or it may be due to excessive stimulation of normal erythroid precursors by the physiological regulator, erythropoietin, in states such as chronic hypoxemia (secondary erythrocytosis).

The prevalence of anaemia was 36% in the present study, and it is rather higher than the prevalence of polycythaemia 36% in COPD (n=50) patient group. Anaemia of inflammation or anaemia of chronic disease are possible causes of initiating COPD, and they contribute to about 30 percent of all anaemia cases observed in the community-dwelling elderly population[3]. The study done by John M et al.,[4] has documented that anaemia in COPD is least partially, due to inflammation and resistance to raised levels of serum erythropoietin Conversely, more research is required for a better understanding of the conceivable reasons of anaemia in COPD. Recent clinical studies have shown that anaemia in COPD has been allied with adversative outcomes. In a study by Chambellan et al.,[5] it was found that anaemia is related with decreased long term survival rate in patients receiving long term oxygen therapy, also observed were increased hospitalisation rate and the duration of hospitalisation compared with non-anemic patients. Studies have shown that every 5% increase in haematocrit the relative risk of death was decreased by 14%, and it was observed that haematocrit was the significant predictor of mortality next to age. It was also found that haematocrit was inversely correlated with both the rate

and duration of hospitalization[1]. Standard literature states that Polycythaemia is seen in COPD patients, but the true prevalence of Polycythaemia among patients with COPD & its long term effects are unidentified. There is inadequate evidence in the current literature relating the distribution of haemoglobin (Hb) and its influence on outcomes in the COPD patients. Polycythaemia, conventionally thought to be vastly prevalent in COPD patients, but recent trends in correction of hypoxia has decreased its prevalence[6]. Recent reports have stated anaemia in patients with COPD is accounting for the increased mortality in COPD patients[7,8].

In the present study it was observed that reduction in the BMI of the COPD patients with polycythaemia and no polycythaemia was statistically significant, similar observations were made by C Cote et al (2), and Davood A et al.,[9]. The role of nutrition as an independent risk factor for development of COPD is unclear. Malnutrition and weight loss can reduce respiratory muscle strength and endurance, apparently by reducing both respiratory muscle mass and the strength of the remaining muscle fibres[10].

A number of diseases, such as chronic obstructive pulmonary disease, diffuse pulmonary infiltrates (fibrosis or granulomatous), kyphoscoliosis and multiple pulmonary emboli, lead to erythrocytosis as the result of insufficient oxygenation of the blood circulating through the lungs. As seen in the present study not all patients with lung disease and decreased arterial oxygen saturation has elevated haemoglobin or haematocrit levels[11,12] and only in roughly 50% there is an increase in red cell mass seen[13]. The justification for this suboptimal response to hypoxia is not clear, but it does not appear to result from a reduction in erythropoietin production or the occurrence of chronic infections[11–13]. When Polycythaemia occurs, it typically is associated with increased MCV condensed MCHC and normal MCH values[13]. The red cell changes have been ascribed to increased water uptake by the cell, which in turn may result from carbon dioxide retention[13]. It has been suggested that carbon dioxide retention may prevent the marrow response, but no confirmatory evidence is available. If polycythaemia is present, it is corrected by chronic oxygen administration[14]. The clinical representation of chronic Cor pulmonale differs, but oxygen deficiency with arterial desaturation and elevated pulmonary artery pressure are of essential features of importance[15,16]. Polycythemia with its related increase in blood viscosity and volume seems to be the physiologic price of a compensatory mechanism progressively stretched to the point at which it is more injurious than beneficial. As in less severe pulmonary disease, the MCV of the red cells tends to be raised, whereas the MCHC commonly is decreased[17].

In the present all the subject had history of smoking. The most common cause of secondary polycythaemia is smoking and in those suffering have, a carboxyhemoglobin-induced increase in red cell mass or decrease in plasma volume, either of which is alterable with smoking cessation[18]. Exposure to excessive carbon monoxide can also be attributed to exposure to industrial releases and automobile exhaust. Carbon monoxide binds to Hb with a more than 200 times greater affinity than oxygen, resulting in not only binding to one of the haem groups of Hb but also an increase in the O2 affinity by the residual haem group. Persons smoking even one pack of cigarettes a day often have elevated haematocrits. These patients typically have normal blood gases, elevation of carboxyhemoglobin levels, causing in a reduction in the P50 O2[18,19]. The raise of the hematocrit is reversed with the stoppage of the smoking behaviour. High haematocrit levels have been observed in 3% to 5% of heavy smokers. Though these patients are not protected to thrombotic complications, the number of thromboembolic events is lesser than in patients with PV. A retrospective analysis of patient with either PV or smokers Polycythaemia found that 60% of those with PV had suffered thromboses, while only 41% of those with smoker are Polycythaemia and thus affected[18,20].

The present study is limited by a relatively small number of understudy patients; another study with a larger sample size is required for better determination of the prevalence of polycythaemia and anaemia in COPD patients.

The present study ruled out polycythaemia only by measuring Hb and haematocrit and it would be better if serum erythropoietin and red cell mass were measured too. In the present study anaemia was identified only by measuring Hb and haematocrit and peripheral smear. It would be better if serum vitamin B12 and folate levels, serum iron, TIBC, and ferritin were measured too.

In brief, currently available arguments suggest that 1) Haemoglobin status in COPD patients could be identified by the balance between the stimulating effects of hypoxia on EPO production and inflammation-induced EPO resistance; 2) As seen in heart failure, anaemia could have a negative prognostic impact on COPD, associated with abridged survival and augmented morbidity; 3) Anaemia could aggravate dyspnoea and exercise capacity 4) Polycythaemia did not seem to be related with either with an increased COPD severity or with improved outcomes.

5. Acknowledgement

None.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Global Strategy for the Diagnosis, Management and Prevention of COPD ; 2007.

2. Cote C. Haemoglobin level and its clinical impact in a cohort of patients with COPD. *Eur Respir J*. 2007;29:923–9.
3. Guralnik JM, Ershler WB, Schrier SL, Picozzi VJ. Anemia in the Elderly: A Public Health Crisis in Hematology. *Hematology Am Soc Hematol Educ Program*. 2005;1:528–32.
4. John M, Hoernig S, Doehner W, Okonko DD, Witt C, Anker SD, et al. Anemia and Inflammation in COPD. *Chest*. 2005;127(3):825–9.
5. Chambellan A, Chailleux E, Similowski T. Prognostic Value of the Hematocrit in Patients With Severe COPD Receiving Long-term Oxygen Therapy. *Chest*. 2005;128(3):1201–8.
6. Zielinski J. Effects of long-term oxygen therapy in patients with chronic obstructive pulmonary disease. *Curr Opin Pulm Med*. 1999;5:81–7.
7. John M, Hoernig S, Doehner W, Okonko DD, Witt C, Anker SD, et al. Anemia and Inflammation in COPD. *Chest*. 2005;127(3):825–9.
8. Chambellan A, Chailleux E, Similowski T. Prognostic Value of the Hematocrit in Patients With Severe COPD Receiving Long-term Oxygen Therapy. *Chest*. 2005;128(3):1201–8.
9. Davood A. Anemia in copd patients and its relation to serum levels of erythropoietin. *Tanaffos*. 2009;8(2):11–6.
10. Sahebjami H, Vassallo CL. Influence of starvation on enzyme-induced emphysema. *J Appl Physiol*. 1980;48(2):284–8.
11. Kenzie SBM. Myeloproliferative disorders. Textbook of Hematology. Lippincott Williams and Wilkins publishers; 1996. p. 328–34.
12. Freedman BJ, Penington DG. Erythrocytosis in Emphysema. *Br J Haematology*. 1963;9(4):425.
13. Callo RC, Fraimow W, Cathcart RT. Erythropoietic response in chronic pulmonary disease. *Arch Intern Med*. 1964;113:559.
14. Murray JF. Classification of polycythemic disorders with comments on the diagnostic value of arterial oxygen analysis. *Ann Intern Med*. 1966;64:892.
15. Chamberlain DA, Millard F. The treatment of polycythaemia secondary to hypoxic lung disease by continuous oxygen administration. *QJM*. 1963;32:341.
16. Fishman AP. General alveolar Hypoventilation: a syndrome of respiratory and cardiac failure in patients with normal lungs. Chronic cor pulmonale. *QJM*. 1966;35(2):26175.
17. Fishman AP. Polycythemia. *Am J Med*. 1958;24:132.
18. Aitchison R, Russell N. Smoking-a Major Cause of Polycythaemia. *J Royal Soc Med*. 1988;81(2):89–91.
19. McAloon EJ, Streiff RR, Kitchens CS. Erythrocytosis Associated With Carboxyhemoglobinemia in Smokers. *South Med J*. 1980;73(2):137.
20. Calverley PMA, Leggett RJ, McElderry L, Flenley DC. Cigarette Smoking and Secondary Polycythemia in Hypoxic Cor Pulmonale1,2. *Am Rev Respir Dis*. 1982;125(5):507.

Author biography

Veerabhadrappa K. Kuppast Assistant Professor

H B Chandrashekar Professor and Head

Umesh Y Ramadurg Associate Professor

Cite this article: Kuppast VK, Chandrashekar HB, Ramadurg UY. **A study of polycythaemia and associated factors in COPD patients attending a tertiary care hospital**. *IP Indian J Immunol Respir Med* 2020;5(2):101-104.