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STUDY ON IRON PROFILE PARAMETERS AND SEVERITY OF COPD AS PER GOLD CRITERIA AT OUR TERTIARY CARE HOSPITAL

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ABSTRACT

Background: The prevalence of COPD in the young Indian population aged 30 is 7%. The most common cause of COPD is tobacco smoke, and the other factors that can cause or make COPD worse are environmental exposures and genetic risk metabolism is altered by inflammation. The iron level in plasma will decrease, with the transferrin.

Aim: To estimate Iron Profile parameters in stable And AECOPD patients. To correlate the iron profile parameters according to severity of COPD using GOLD criteria (2021).

Methods: A total number of 302 patients were included in the study. This includes 151 stable COPD patients and 90 AECOPD patients of the age group of 30 to 60 years of age group. Venous blood was drawn from patients for iron profile parameters in a plain vial and performed the test at the Central Biochemistry laboratory at the National Institute of Medical Sciences and Hospital (NIMS Hospital) where serum iron, ferritin, Total iron binding capacity (TIBC), and Transferrin saturation (TS%) were measured. Student's t-test was used for the comparison of iron profile parameters.

Results: There is a significant decrease in the level of serum iron and TS% in acute exacerbation (AE) COPD as compared to stable COPD patients ($p < 0.001$). There is a significant increase in the level of serum ferritin and TIBC in acute exacerbation (AE) COPD as compared to stable COPD patients ($p < 0.001$).There is no significant difference in iron profile parameters with the severity of the disease ($p>0.05$).

Conclusion: The present study highlights the low level of serum iron and TS% and high level of serum ferritin and TIBC in acute exacerbation (AE) COPD patients as compared to stable COPD patients. The study did not find a statistically significant correlation between the iron profile parameters and the severity of COPD.

Keywords: severity of disease, severity, iron profile parameters, AECOPD, gold criteria, COPD: chronic obstructive pulmonary disease.

INTRODUCTION

The chronic obstructive pulmonary disease represents a progressive, incurable illness, whereas progressive refers to a condition that worsens with time. Emphysema and chronic bronchitis are the two primary diseases that makeup COPD.[1] Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death worldwide, causing 32.3 lakhs deaths in 2019.[2] The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines are used to determine the severity of chronic obstructive pulmonary disease. Spirometry should be used annually for a clinical evaluation of COPD, according to the GOLD criteria.[3]

Around the world, between 25 and 45 percent of COPD patients have never smoked. The burden of COPD as a whole is linked to occupational exposures in 14% of cases.[4] The body's iron homeostatic system maintains equilibrium to prevent free iron radicals. The body's overall iron reserves, particularly those in the macrophage and hepatocytes, are depleted in an iron deficit. Larger quantities of iron are consumed because hemoglobin is produced.[5] Ferritin consists of a protein shell surrounding an iron core. Ferritin in hepatocytes and macrophages provides are serving of iron that is available for the synthesis of Hemoglobin (Hb) and other heme proteins.[6] The post-bronchodilator measurement of FEV1 (% reference) is used to assess the degree of airflow limitation in COPD whenever the FEV1/FVC ratio goes less than 0.7 (notice that this may differ from disease severity).[7]

We have conducted this study to estimate Iron Profile parameters [Total iron, Ferritin, Total Iron Binding Capacity test (TIBC) & % transferrin saturation test (%TS)] in stable And AECOPD patients and also to correlate the iron profile parameters according to severity of COPD using GOLD criteria (2021).

MATERIALS AND METHODS

Source of data and study design: It is a comparative study, conducted at the National Institute of Medical Sciences & Hospital (NIMS Hospital), Jaipur (Rajasthan) in the Department of Biochemistry in association with the Department of Respiratory Medicine and General Medicine. Samples were analyzed for biochemical investigations in the Department of Biochemistry, National Institute of Medical Sciences & Research (NIMS&R) and NIMS Hospital, Jaipur.

Inclusion criteria: All patients between 30 to 60 years of age and clinically diagnosed COPD patients.

Exclusion criteria: Patients with other types of anemia, patients with Tuberculosis, Hepatic and renal disorders, cardiovascular disease, diabetic mellitus, hypertensive drugs, iron supplementation, and pregnant or lactating women.

Sample collection: Venous blood was drawn from patients for iron profile parameters in a plain vial and performed the test at the Central Biochemistry laboratory at NIM Hospital where serum iron, ferritin, Total iron binding capacity (TIBC), and Transferrin saturation (TS%) were measured.

Iron profile parameters: Serum Iron was measured through DiruiCST-180 by Photometric method, Ferritin was performed MAGLUMI X3 by Chemiluminescence immunoassay, and TIBC and TS% were calculated.

Statistical analysis: All data was presented in number %. Mean and Standard Deviation were used to determine the data. Student's t-test was used for the comparison of iron profile parameters in stable COPD and AECOPD patients. The Chi-square test was used for the correlation of serum electrolyte levels in stable COPD patients. A p-value less than 0.05 were considered statistically significant.

RESULTS

A total number of 302 patients were included in the study. This includes 151 patients of stable COPD and 151 patients of AECOPD of age group of 30 to 60 years. There are 84 and 67 were males and females in stable COPD group whereas 94 and 57 were males and females in AECOPD group.

It is evident from the table no 1 that they were decreased levels of serum iron and TS% and increased levels of serum ferritin and TIBC in AECOPD patients compare to stable COPD patients, which was statistically highly significant ($p<0.001$). It is evident from Table No. 2, 3, 4 and 5 that the level of serum iron, serum ferritin, TIBC and TS% did not show statistically significant correlation respectively with the severity of COPD as per GOLD criteria[8] ($p>0.05$).

DISCUSSION

In the present study, we included a total of 302 patients based on inclusion and exclusion criteria. These patients were divided into 151 stable COPD group and 151 AECOPD group. The mean age (years) in stable COPD and AECOPD patients was 47.03 ± 10.31 years and 45.25 ± 8.9 years respectively.

We evaluated serum iron, ferritin, TIBC, and TS% in both groups. The normal reference ranges used for these parameters where serum iron was 45- 182 µg/dl, serum ferritin was 30-300 ng/ml, and TIBC and TS% were 255-450 µg/dl and 20-50% respectively.[9] We found statistically significant decreased levels of serum iron and TS% and increased levels of serum ferritin and TIBC in AECOPD patients compare to stable COPD patients ($p<0.001$).

Mi-Hye Kim et al. (2018) found that the FEV1 was positively correlated with serum hemoglobin, iron, transferrin saturation, and ferritin, and negatively correlated with age and lower in female patients.[10] Sunil Kumar Gothwal et al. (2022) found that the Serum iron, TIBC, and %TS were found to be highly significant and positively correlated with FEV1.[11] Hirayama Fumi et al. found that lung function is positively associated with dietary iron.

Epidemiological evidence also indicated a possible inverse association between dietary iron intake and COPD risk while iron intake was also associated with a reduced lung cancer risk.[12] Anabel H Nickol et al found that iron deficiency was more common in COPD patients compared with controls.[13]

The two main kinds of anemia found in COPD are iron deficiency anemia (IDA) and anemia of chronic disease (ACD), with ACD accounting for the majority of cases. Changes in iron balance are connected to both of these. Due to the impact of the inflammatory effect on iron metabolism, many people feel appropriate ferritin should have been defined differently in the context of chronic inflammation. IDA in COPD has traditionally been characterized by the presence of anemia with a low ferritin level as denoted by Pizzini A et al.[14] When a deficit is suspected, ferritin, total iron binding capacity (TIBC), and transferrin saturation are all frequently evaluated; however, each of these measurements is known to change in response to inflammation. To assist mobilize and distribution of iron, there is a rise in transferrin production in simple iron deficiency. This leads to a drop in free iron and ferritin, an increase in the number of accessible transferrin binding sites, and a decrease in transferrin saturation as mentioned by Vasquez A et al.[15] Iron responsive element binding protein 2, which is induced by mitochondrial iron loading and elevated in COPD, has previously been connected to the disease. Although mitochondrial iron loading compromises mitochondrial activity and oxidative phosphorylation, it lacks appears to reduce cigarette smoke-induced lung inflammation was similar to the results studied by Cloonan SM et al and Volani C et al.[16,17] In order to provide better patient care, special efforts should be undertaken to enhance the clinical treatment of anemia or deficiency of iron in COPD patients.

In this study, we also found no significant correlation between serum iron parameters and the severity of disease in stable COPD patients.

Limitations of study:

Selection bias: The participant in the study is not representing the broader population of the COPD patients.

Confounding factors: There are many other factors which are in influence the relationship between iron profile parameters and COPD severity like Smoking history, and medications used in the treatment.

Timing of measurement: Iron profile parameters can fluctuate over the time, so the timing of measurements may be influencing the results. For example, iron level may be affected by recent infections or medications.

CONCLUSION

In this study, the number of males is higher as compared to females in both stable COPD and AECOPD patients. The iron profile parameters are highly significant in AECOPD patients as compared to Stable COPD patients. The study highlights the low level of serum iron and TS% and high ferritin and TIBC levels in acute exacerbation (AE) COPD patients as compared to Stable COPD patients. There should be continuous monitoring of the iron profile parameters in Stable COPD as well as AECOPD patients. There is no correlation of serum iron profile parameters, i.e., iron, ferritin, TIBC and TS% in stable COPD patients on the basis of severity of disease. This study provides important insights into the role of iron profile parameters in the pathogenesis and progression of COPD, which help in improve our understanding of the disease. The study also identifies the potential biomarkers that can be used to monitor disease progression and response to treatment.

REFERENCES

1. NIH /NHLBI/Health topic/COPD. https://www.nhlbi.nih.gov/health-topics/copd
2. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death (9 December 2020).
3. Global Initiative for Chronic Obstructive Lungs Disease. ©2020 Global Initiative forChronicObstructiveLungs Disease, inc.www.goldcopd.org.
4. Lisa R, Sood A. Epidemiology of chronic obstructive pulmonary disease. Clin Chest Med; 2020; 41(3):315-327.
5. Camaschella C. Iron metabolism and its disorders. American Society of Hematology; 2019; 133(1): 30-39.
6. M. Koorts & M. Viljoen (2007) Ferritin and ferritin isoforms I: Structure-function relationships, synthesis, degradation and secretion, Archives of Physiology and Biochemistry, 113:1, 30-54,
7. Kakavas, S., Kotsiou, O.S., Perlikos, F. *et al.* Pulmonary function testing in COPD: looking beyond the curtain of FEV1. *npj Prim. Care Respir. Med.* 31, 23 (2021).
8. Peter C. Current drug treatment, chronic and Acute, Clin Chest Med, 2014; 35(1): 177-189.
9. Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for medical students. Jaypee

Brothers Medical Publications (P) Ltd 2023:843-847.

10. Kim MH, Kim Y H, Lee D C. Relationships of Serum Iron Parameters and Hemoglobin with Forced Expiratory Volume in 1 Second in Patients with Chronic Obstructive Pulmonary Disease. Korean J Fam Med, 2018;39:85-89.
11. Gothwal SK, Palsaniya V, Barjatiya HC, Banseria R, Sharma P, Goyal PK et al. Study of lung function test in association with laboratory findings of serum iron in patients with chronic obstructive pulmonary disease. Clinical Epidemiology and Global Health, 2022; 16: 101091.
12. Hirayama F, Lee A H, Oura A, Mori M, Hiramatsu N, Taniguchi T. Dietary intake of six minerals in relation to the risk of chronic obstructive pulmonary disease. Asia Pac J Clin Nutr 2010;19 (4):572-577.
13. Nickol AH, Frise MC, Cheng H-Y, McGahey A, Khandwala S, Robbins P, et al. A cross-sectional study of the prevalence and associations of iron deficiency in a cohort of patients with chronic obstructive pulmonary disease. BMJ Open 2015;5: e007911.
14. Pizzini A, Aichner M, Sonnweber T, Tancevski I, Weiss G, Löffler-Ragg J. The Significance of iron deficiency and anemia in a real-life COPD cohort. Int J Med Sci 2020; 17(14):2232-2239. doi:10.7150/ijms.46163. https://www.medsci.org/v17p2232.htm
15. Vasquez A, Logomarsino JV. Anemia in Chronic Obstructive Pulmonary Disease and the potential role of iron deficiency. Journal of Chronic Obstructive Pulmonary Disease, 2015; 13 (1): 101 – 109.
16. Cloonan SM, Glass K, Laucho-Contreras ME, Bhashyam AR, Cervo M, Pabón MA. *et al*. Mitochondrial iron chelation ameliorates cigarette smoke-induced bronchitis and emphysema in mice. *Nat Med.* 2016;22(2):163-74
17. Volani C, Doerrier C, Demetz E, Haschka D, Paglia G, Lavdas AA. *et al*. Dietary iron loading negatively affects liver mitochondrial function. *Metallomics: integrated biometal science.* 2017;9(11):1634-44.

TABLES

Variables	Stable COPD (n=151)	AECOPD (n=151)	t-test	P-Value	Significance
Age(years)	47.03±10.31	45.25 ±8.9	1.606	0.10934	Not Significant (p>0.05)
Iron (µg/dl)	55.76±44.83	36.04±21.83	4.862	0.00001	Highly Significant (p<0.001)
Ferritin(ng/ml)	173±177	281.3±292.14	-3.897	0.00012	
TIBC(µg/dl)	339.6±113	394.9±164	-3.400	0.00076	
TS%	18.92±17.55	11.5 ±9.55	4.584	0.00001	

TABLE 1: Shows Comparison of Iron profile parameters between Stable COPD & AECOPD patients

Variables	Mild (n=8)	Moderate (n= 67)	Severe (n=51)	Very severe (n=25)	Chi-square	p-Value	Significance
<45	5	33	27	13	0.567	0.90407	Not Significant (p>0.05)
45-182	3	30	23	12			
>182	0	4	1	0			

TABLE 2: Shows the Association between the severity of disease & Iron level

Variables	Mild (n=8)	Moderate (n= 67)	Severe (n=51)	Very severe (n=25)	Chi-square	p- Value	Significance
<30	5	13	11	2	3.7	.071717	Not Significant (p>0.05)
30-300	4	42	32	16			
>300	2	12	8	7			

TABLE 3: Shows the Association between the severity of disease & Ferritin level.

Variables	Mild (n=8)	Moderate (n= 67)	Severe (n=51)	Very severe (n=25)	Chi-square	p- Value	Significance
<255	5	13	13	7	2.718	0.84335	Not Significant (p>0.05)
255-450	4	45	30	16			
>450	1	9	8	2			

TABLE 4: Shows Association between severity of disease & TIBC level

Variables	Mild (n=8)	Moderate (n= 67)	Severe (n=51)	Very severe (n=25)	Chi-square	p- Value	Significance
<20	6	45	33	17	1.454	0.86476	Not Significant (p>0.05)
20-50	1	18	14	8			
>50	1	4	4	0			

TABLE 5: Shows the association between the severity of disease & TS% level

GOLD Stage	Severity	Spirometry
I	Mild	FEV1/FVC < 0.7 and FEV1 ≥ 80% predicted
II	Moderate	FEV1/FVC < 0.7 and FEV1 ≥ 50% but <80% predicted
III	Severe	FEV1/FVC <0.7 and FEV1 ≥ 30% but <50% predicted
IV	Very Severe	FEV1/FVC <0.7 and FEV1 ≥ 30% predicted

TABLE 6: The following are the spirometry severity ratings currently supported by GOLD

FEV1: Forced Expiratory Volume in one second
FVC: Forced vital capacity