Original Article

Biochemistry Section

Comparison of Serum CRP, Total Cholesterol, Magnesium and Uric Acid in Smoker and Non Smoker Patients with COPD: A Cross-sectional Study

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a common and treatable disease characterised by progressive airflow limitation and tissue destruction. Smoking is a common risk factor but non smokers can also develop COPD. There may be change in serum level of inflammatory marker, oxidative stress markers, bio-markers among these patients. In this study smoker and non smoker group in COPD patients studied and may helpful for comparing levels and to corelate with severity of disease and also for group specific management.

Aim: To evaluate the level of Serum C-Reactive Protein (CRP), total cholesterol, Magnesium (Mg++), and uric acid in COPD patients and also, to compare these parameters in smoker and non smoker patients with COPD.

Materials and Methods: This cross-sectional study was conducted in Department of Biochemistry and Department of Pulmonary Medicine at People's College of Medical Sciences and Research Centre, Bhopal, Madhya Pradesh, India, from October 2021 to December 2022. A total of 100 COPD patients, aged between 40 to 60 years were included and divided into

two groups: 50 smokers and 50 non smokers. Parameters such as CRP, Mg++, total cholesterol and uric acid, were estimated by autoanalyser. Data were statistically analysed using unpaired t-test.

Results: In smokers, mean age was 53.08±5.89 years, whereas in non smokers, mean age was 53.9±4.84 years. Out of the 100 subjects, 50 were smokers (F=6 and M=44) and 50 were non smokers (F=6 and M=44). In the present study, observed increased CRP levels and cholesterol levels, low serum magnesium, and normal uric acid in smoker compared to non smokers COPD. There was significant difference in cholesterol (p-value=0.044), serum magnesium (p-value=0.001) and CRP levels (p-value=0.0001) but there was no significant difference in uric acid (p-value=0.989).

Conclusion: Smokers with COPD had increased level of CRP, Cholesterol and low level of Magnesium as compared to non smoker COPD patients. This may attribute that smokers COPD patients are in risk of developing recurrent exacerbations and more disease severity.

INTRODUCTION

The COPD is characterised by minimally reversible or irreversible airflow limitation [1]. It is associated with structural lung changes due to chronic inflammation from prolonged exposure to noxious particles or gases most commonly cigarette smoke [2]. COPD is a multisystem disease characterised by both pulmonary and systemic inflammation. Pulmonary inflammation is a result of the abnormal inflammation of the lungs to noxious gasses and particles [1]. The COPD can occur in smokers also in non smoker. Tobacco smoke is the most common cause of COPD. Non smoker cause of COPD are exposure to biomass, occupational exposure and passive smoking to having a history of asthma, tuberculosis or respiratory infections during childhood [3]. There are various markers deranged in COPD.

Although primarily affecting the lungs, the chronic inflammatory process of COPD does have systemic involvement. CRP is an inflammatory marker and raised level correlated with higher incidence of myocardial infraction, stroke and sudden coronary death [4]. According to data from previous studies, high level of cholesterol as a part of a metabolic syndrome in COPD patients is associated with more serious and more frequent exacerbation [1,5]. Magnesium has an important role in regulating bronchial tone and respiratory muscle function and its defiency lead to excerabation of pulmonary disesase [6]. Researches found that tissue hypoxia in COPD were associated with higher level of serum uric acid [7].

Very few studies [8,9] has been done on comparison of smokers COPD versus non smokers COPD with above mention parameters. Also, no such study was previously done in this region of the India, comparing these parameters among smokers and non smokers. The present study may helpful for research purpose and role in management of patients by monitoring these parameters. Hence, present study was conducted to evaluate the level of serum CRP, total cholesterol, magnesium, and uric acid in COPD patients and also to compare these parameters in smoker and non smoker patients with COPD.

MATERIALS AND METHODS

This cross-sectional study was conducted in Department of Biochemistry and Department of Pulmonary Medicine at People's College of Medical Sciences and Research Centre, Bhopal, Madhya Pradesh, India, from October 2021 to December 2022. The present study was approved by Ethical and Research Committee of People's College of Medical Sciences and Research Centre {IEC REF. NO. PCMS/OD/2022/445(7)}.

Inclusion criteria: Smoker and non smoker patients, age between 40-60 years, diagnosed with COPD, based on Gold criteria spirometric FEV1/FVC ≤0.7 and no postbronchial reversibility [10], were included in the study.

Exclusion criteria: Patients below 40 years, chronic alcoholic, not giving consent for study were excluded from the study.

Sample size calculation: Sample size calculated was 100 as per $N=4pq/L^2$ formula. {P=Prevalence [11], q=(1-P), L^2=error (5%)}.

Study Procedure

Data for the present study were collected from Department of Pulmonary Medicine. COPD patients were selected from Out-Patient Department/In-Patient Department (OPD/IPD), they were grouped in smokers and non smokers as per history after taking the written consent form in English and Hindi language. Total 100 patients were divided into smoker (50) and non smoker (50). Parameters CRP, serum magnesium, uric acid and cholesterol were estimated by respective methods i.e., latex turbimetery, xylidyl blue, Uricase Trinder and endpoint reaction by using autoanalyser.

Reference values: CRP upto 6 mg/dL [12], Mg^{++} 1.7-2.4 mg/dL [13], Total cholesterol < 200 mg/dL [14], Uric acid 3.6-7.2 mg/dL [13]

STATISTICAL ANALYSIS

The data were entered into excel work sheet and were analysed using Statistical Package for the Social Sciences (SPSS) version 25.0. Result on continuous measurement was presented on Mean±Standard Deviation (SD) and statistically analysed using unpaired t-test. The p-value equal or less then 0.05, was considered as statistically significant.

RESULTS

The present study was conducted to estimate the levels of serum CRP, total cholesterol, magnesium and uric acid in smoker and non smoker COPD patients. Out of total 100 COPD patients, 50 patients were enrolled in each group of smokers and non smokers. In smoker, mean age was 53.08±5.89 years, whereas in non smokers, mean age was 53.9±4.84 years. In both the groups, gender distribution was equal with 44 males and six females in each group. It is observed that Forced Expiratory Volume in 1 second (FEV_1) was significantly lower in smokers indicating that, smokers have more severe obstruction compare to non smoker COPD [Table/Fig-1].

Parameters	Smoker	Non smoker	p-value
Gender	Males- 44 (88%)	Males- 44 (88%)	-
	Females- 6 (12%)	Females- 6 (12%)	
Age (in years)	53.08±5.89	53.9±4.84	0.44
FEV_1	45±6.2	52±8.1	0.0001
FVC	72±8.1	74±9.0	0.2457
FEV_1/FVC	0.62±0.76	0.70±0.9	0.6321

[Table/Fig-1]: Comparison of demographic data between smokers and non smokers COPD patients.
FEV_1- Forced expiratory volume in 1 second, FVC- Flow controlled ventilation; Unpaired t-test, level of significant p-value <0.05

Serum CRP levels and serum cholesterol level was significantly higher in smoker COPD patients than non smoker COPD patients. Serum magnesium level was significantly lower in smoker COPD patients compare than non smoker COPD. There was no significant difference in uric acid level in both groups [Table/Fig-2].

Parameters	Smokers	Non smokers	p-value
CRP	6.99±2.4	4.6±1.5	0.0001
Cholesterol	188.34±44.03	173.86±33.34	0.044
Mg^{++}	1.69±0.29	2.9±0.66	0.001
Uric acid	5.04±1.56	5.05±1.77	0.989

[Table/Fig-2]: Comparison of parameters among smokers and non smokers COPD patients.
All values presented in mg/dL; Unpaired t-test, level of significant p-value <0.05

DISCUSSION

The COPD is a common, preventable and treatable chronic lung disease which affects men and women worldwide. Abnormalities in the small airways of the lungs lead to limitation of airflow in and out of the lungs [15]. The authors observed differences in various parametres in COPD smoker and non smoker patients. A study done by Ata MA et al., of 192 subjects including 96 smokers and 96 non smokers (age range 20-40 years) and found that mean serum CRP concentration in smokers (14.62±0.16 mg/L) against the non smokers (4.81±0.38 mg/L) was significantly higher (p-value <0.001) [16]. In present study, it was observed that serum CRP level was significantly higher in smokers COPD patients. Similar finding of higher CRP level in COPD patients was observed in a previous study [17]. Higher CRP level is a risk factor for recurrent exacerbations and severe disease.

A study done by Sundaram R et al., showed that total cholesterol level and LDL level, significantly increased with increasing staging of COPD [17]. In the present study, serum cholesterol level was significantly increased in smokers COPD patients. Compared to non smoker COPD patients, smoker COPD patients may develop more metabolic problems such as dyslipidemia, hypertension etc., [17]. A study done by Khand F et al., showed that out of the total 96 subjects in the study, 48 (50%) each represented the two groups. The results of mean serum magnesium concentration in non smokers (2.52±0.18 mg/L) as compared to smokers (1.09±0.38 mg/L) was significantly higher (p<0.001) [18]. In present study also, serum Mg++ level was significantly lower in smoker COPD patients. Lower Mg level is associated with severe COPD condition and requires proper management.

A study done by Sontakke A et al., found that serum uric acid level was higher in patients of severe stages of COPD [19]. In present study, no significant difference in serum uric acid level was found but in both groups uric acid level was higher than the normal range. This may be due to oxidative stress level affected equally in non smoker and smoker COPD patients, may require study in larger group [19].

Limitation(s)

Severity stage of COPD patients not included in study, this may evaluate severity stage-wise level change of parameters.

CONCLUSION(S)

In smokers having COPD, CRP is raised significantly indicating risk of severe COPD is more compared to non smokers COPD patients. In smokers, COPD magnesium level is low, low magnesium is associated with poor control of symptoms in COPD patients. Similarly, high cholesterol level observed in smokers COPD they are more prone for developing severe COPD and metabolic problems, compared to non smokers. Further studies can be done together with other parameters like IL-6, TNF alpha, LDL, HDL in smoker and non smoker COPD patients.

REFERENCES

[1] Ivanovska BZ, Stojkovikj J. The level of cholesterol in COPD patients with severe and very severe stage of the disease. Open Access Maced J Med Sci. 2016;4(2):277-82.

[2] Anuj K. Agarwal; Avais Raja; Brandon D. Brown. Chronic Obstructive Pulmonary Disease, National library of medicine.PubMed; 2022;4(3).

[3] Sandoval AP, Ravina AR, Pedreira CC. Risk factors for chronic obstructive pulmonary disease in never-smokers: A systematic review. Clin Respir J. 2022;16:261-75.

[4] Plata VMP, ̀llerova HM, Toso JF, Tepie MF, Soriano JB, Vessey BS. C-reaction protein in patients with COPD, control smoker and non smokers.Thorax. 2006;61:23-28.

[5] Küpeli E, Ulubay G. Metabolic Syndrome is associated with increased risk of acute exacerbation of COPD: a preliminary study. Original Article. 2010;38:76-82.

[6] Kshirsagar K, Virendra CP. Chronic obstructive pulmonary disease: Is serum magnesium level a risk factor for its acute exacerbation? Caspian J Intern Med. 2021;12(2):223-27.

[7] Sahana K, Sivaranjani H. Uric Acid: A Mirror to the lungs in COPD. J Assoc Physicians India. 2022;70(4):11-12.

[8] Pandeya S, Garga R, Kanta S, Gaur P. Vitamin D, C-reactive protein, and oxidative stress markers in chronic obstructive pulmonary disease. Tzu Chi Medical Journal. 2021;33(1):80-86.

[9] Balaji K, Shankar P. Study of effect of duration and severity of smoking on serum magnesium levels in young smoker. J Evid Based Med Healthc. 2019;6(27):1858-62.

[10] Globle initiative for chronic obstruction lung disease 2023 report , https://goldcopd.org/2023-gold-report-2.

[11] Prevalence of COPD in India: A systemic review. July; primary care respiratory journal: journal of the general practice's airways group. 2012;21(3):313-21. pubmed.

[12] Merillife [Internet]. C-reactive protein. India 2021. Available from -c-reactive-protein-1646218723.pdf (merillife.com).

[13] Tietz textbook of clinical chemistry and molecular diagnostics, 4th ed. Burtis CA, Ashwood ER, Bruns DE. WB Saunders Co, 2005.

[14] NCEP Expert panal. NCEP expert panel on detection, evalution and treatment of high blood cholesterol on adults (ATP III). NIH Publication, Bethesda: national heart, lung and blood institute 2001.

[15] World health organization, Chronic obstructive pulmonary disease. 20 may 2022.

[16] Ata MA, Shaikh SS, Hina TI, Jamil D, Khan R, Qazi MB, et al. Inverse correlation between serum C-reactive protein and magnesium levels in smokers and non smokers. N Am J Med Sci. 2015;7(6):271-74.

[17] Rajan Sundaram, Thangavel Jayaprkash, Jayaraman Sangumani, Dinesh Ravichandran. An observation study to compare lipid profile status in stable COPD patients and its correlation with COPD related factors. Indian Journal of Applied Research. 2018;8(10).

[18] Khand F, Shaikh SS, Ata MA, Shaikh SS. Evaluation of the effect of smoking on complete blood counts, serum C-reactive protein and magnesium levels in healthy adult male smokers. Pak Med Assoc. 2015;65(1):59-61.

[19] Sontakke A, Kharwade S, Tayade BO. Correlation of serum uric acid levels in patients of chronic obstructive pulmonary disease. Panacea Journal of Medical Sciences. 2018;8(1):16-20.

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