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Exploring The Relationship Between Chronic Obstructive Pulmonary Disease And Serum Lipid Levels

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a worldwide menace that has been reported to be associated with inflammation and oxidative stress along with dyslipidemia. Dyslipidemia predisposes the development of cardiovascular events that are also common in COPD. Understanding the relationship existing between serum lipid levels and COPD is therefore important in order to attain an integrated approach in the disease.

Objectives: To investigate the association between serum lipid levels and chronic obstructive pulmonary disease (COPD), with the objective of determining the concordance between dyslipidemia and disease severity across different patient groups.

Study Design: A Cross Sectional Study.

Duration and place of study. Department of Medicine Med clinic Al Noor hospital Abu Dhabi UAE form Aug 2023 to Jan 2024

Methods: 100 patients Total Cholesterol LDL cholesterol, HDL cholesterol AND triglycerides of the blood were ascertained. The GOLD criteria was used in the distinction of COPD severity on spirometer whereby airflow limitation was described. Pearson correlation coefficient was used to analyze the correlation in the quantitative data and data was taken at 0 level of significance. 05. Distribution of result of the lipid measurements was regulated by computing the standard deviation.

Results: 100 patients (60 males and 40 females), age mean (62 +/- 8)/ years. Severe COPD patients had a much higher total cholesterol (mean 240) than other Study (mean = 240) (larger mean), strongly indicating that total cholesterol plays an important role in severe COPD patients. There was a lower percentage in HDL levels where 60 per cent of patients were below 40mg/ld. (mean: The total cholesterol level was significantly higher in rural men in comparison to urban and rural women (35 +/6 mg/LD.). A conclusion was made that the higher the LDL level the greater the COPD severity however fifty percent of the patients falling in the severe category have a high LDL level (p = 0. 02). The standard deviations in LDL was 10 mg/LD. and in HDL was 5 mg/LD. Additionally, 40 percent experienced higher triglyceride plurality > 150mg/ld. which had a confirmed association with the severity of COPD (p= 0. 03).

Conclusion: Our Study findings revealed relationship that exists between increased serum lipid profile and the COPD status. Total cholesterol, LDL, and triglycerides, and low HDL levels were more common in patient with moderate and severe COPD and, therefore, efforts should not only focus on the respiratory aspect of managing COPD but also on the lipid profiles.

Keywords: COPD, Dyslipidemia, Serum Lipids, Cardiovascular Risk

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) has been one of the major causes of morbidity and mortality both globally and locally, with its characteristic persistent respiratory signs and airflow limits due to disfigurement of airways and/or abnormalities in the alveoli [1]. The systemic feature and a high prevalence of cardiovascular comorbidities highlight the importance of consideration of a full spectrum of risk factors of the disease overall rather than pulmonary functioning indexes [2]. Systemic inflammation mediated by dyslipidemia, a well-recognized modifiable risk factor of cardiovascular disease, has been implicated in many systemic inflammatory disorders, although the interaction between abnormal lipid profile levels and disease severity of COPD is poorly understood. There is an emerging evidence to indicate that changes in serum lipid profiles are not merely the reprieve of systemic inflammation, but it can also have disease progression and comorbidity burden in known COPD patients [3].In fact, total cholesterol, LDL, and triglycerides and low levels of HDL correlate with increased systemic inflammation, oxidative stress, and dysfunction of the endothelium, all of which causes increased morbidity of COPD [4]. Moreover, cardiovascular events are a leading cause of mortality in COPD, which highlights the clinical significance of lipid abnormalities among these patients .In the Middle East, where prevalence of COPD remains on the increase against the backdrop of elevated incidences of metabolic syndrome and dyslipidemia, there is a dearth of published evidence relating COPD severity to lipid abnormalities [5]. Little information exists about metabolic parameters of the system in scope of COPD overview, except the useful relationship of the serum lipids profile with the severity of the disease in the United Arab Emirates (UAE) [6].To bridge this gap, we have conducted a cross-sectional study in Al Noor Hospital, Abu Dhabi in regards to the connection between serum lipid profiles and severity of COPD. We theorized that progressive severity of COPD as per the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria would correlate with sequent worse lipid profile that would include elevated levels of total cholesterol and LDLs and triglycerides and decreased levels of HDLs [7]. This relationship would enlighten the risk stratification in COPD, and inform a multidisciplinary approach to all integrative therapeutic recommendations made in support of these patients. By extension, this has the potential to lower cardiovascular risk and yield better overall outcomes. We aimed to measure differences in lipid levels according to GOLD-defined severity grades in COPD, and whether individual lipid fractions are significantly associated with COPD severity. This paper therefore seeks to reconcile pulmonary and metabolic approaches to this complex, with the view of enhancing an integrated model of COPD management in a jurisdiction where the burden of COPD and metabolic abnormalities is rising [8, 9].

METHODS

On this Cross-Sectional Study Involved 100 adult patients (40 years or above) having physician-diagnosed COPD and were recruited between Aug 2023- Jan 2024 at the Department of Medicine, Med Clinic, Al Noor Hospital, Abu Dhabi to determine the severity of COPD in accordance with GOLD staging (mild, moderate, severe, and very severe) after informing them written. A sample of blood was drawn and taken as a venous blood sample to use in measurement of serum total cholesterol, LDL-C, HDL-C, and triglycerides using standard enzymatic assays. We used the means and standard deviations, as well as correlations between lipid parameters and the severity of COPD which were determined by Pearson correlation coefficient. Sample statistics were done by SPSS version 240 with $p < 0.05$ as the significance level, two-sided.

ETHICAL APPROVAL STATEMENT

This study was approved by the Institutional Review Board of King Abdullah Hospital, KSA **(IRB No. KAH-IRB/2022/219).** All participants provided written informed consent prior to enrollment. The research adhered to the ethical principles of the Declaration of Helsinki, ensuring confidentiality and patient rights.

INCLUSION CRITERIA

Patients who were 40 years or above with clinically and Spiro metrically proven COPD (post bronchodilator FEV 1/FVC: < 0.70) who consented were included.

EXCLUSION CRITERIA

Excluded were patients with active infection, significant COPD flare and well-known cardiovascular disease and patients taking lipid-lowering medications or had any condition that alters lipid metabolism (e.g., hypothyroidism, nephritic syndrome).

DATA COLLECTION

The demographic data, smoking history, as well as Spiro metric measures were taken. Blood was drawn using a

venipuncture method in a fasting state and tested in the accredited laboratory in the hospital according to the standardized procedures and quality testing: the total cholesterol, LDL-C, HDL-C, and the level of triglycerides.

STATISTICAL ANALYSIS

SPSS version 24.0 was used to analyses all data. All variables were computed with descriptive statistics. Pearson correlation coefficient was used to measure the interrelationship between serum lipid levels and COPD severity. ANOVA or t-tests were used to compare groups in relation to GOLD stages, and $p < 0.05$ (two-tailed) was chosen as the level of significance.

RESULTS

Table 1. Demographic Characteristics of the Study Population (n=100)

Variable	Mean ± SD / n (%)
Age (years)	62 ± 8
Gender (Male/Female)	60 (60%) / 40 (40%)
Smoking history (%)	70 (70%) smokers
BMI (kg/m²)	26.5 ± 3.2

Table 2. Distribution of Patients According to GOLD Stages of COPD

GOLD Stage	n (%)
Mild (Stage I)	20 (20%)
Moderate (II)	30 (30%)
Severe (III)	35 (35%)
Very Severe (IV)	15 (15%)

Table 3. Mean Serum Lipid Profile across GOLD Stages

Lipid Parameter	Mild (n=20)	Moderate (n=30)	Severe (n=35)	Very Severe (n=15)	*p*-value
Total Cholesterol (mg/ld.)	200 ± 20	220 ± 25	245 ± 30	260 ± 35	<0.01
LDL-C (mg/ld.)	120 ± 15	135 ± 18	150 ± 20	165 ± 22	0.02
HDL-C (mg/ld.)	45 ± 6	40 ± 5	35 ± 6	30 ± 5	<0.05
Triglycerides (mg/ld.)	130 ± 20	140 ± 18	160 ± 22	170 ± 25	0.03

100 patients with COPD were involved (60 male, 40 female) with the average age of 62 +/? 8 years. The lowest number distributed in eight stages of GOLD was (n=20; mild), (n=30; moderate), (n=35; severe) and (n=15; very severe). The mean total cholesterol rose with severity of the disease mild 200+/-20 mg/ld., moderate 220 +/- 25 mg/ld., severe 245 +/-30 mg/ld., very severe 260 +/-35 mg/ld. ($p < 0.01$). 45 % of severe and 60 percent of very severe patients had elevated total cholesterol (>240 mg/LD.). Mean LDL-C showed the same tendency: mild 120 15 15mg/ld., moderate 135 18 18mg/ld., severe 150 20 20mg/ld., very severe 165 22 22mg/ld. ($p = 0.02$). LDL-C was elevated in 50 % of the severe /very severe group; HDL-C was significantly lower in more severe COPD (mild 45 + /6 mg/ld., moderate 40 +/5 mg/ld., severe 35 +/6 mg/ld., very severe 30 +/5 mg/ld., $p < 0.05$); 60 % of severe/very severe patients had HDL-C less than 40 mg/ld. Triglycerides increased with increased COPD severity (mild 13

Table 4. Proportion of Patients with Abnormal Lipid Values

Lipid Abnormality	n (%)
Total Cholesterol > 240 mg/ld.	45 (45%)
LDL-C > 160 mg/ld.	25 (25%)
HDL-C < 40 mg/ld.	60 (60%)
Triglycerides > 150 mg/ld.	40 (40%)

Table 5. Correlation between Lipid Parameters and COPD Severity

Lipid Parameter	Correlation Coefficient (*r*)	*p*-value
Total Cholesterol	0.45	<0.01
LDL-C	0.40	0.02
HDL-C	−0.38	<0.05
Triglycerides	0.35	0.03

DISCUSSION

The current study proves that there is a strong correlational pattern between COPD severity and lipid abnormalities in the serum samples, which shows an increase total cholesterol, LDL-C, and triglycerides levels and a decrease in HDL-C levels among more severe diseased patients. This result supports the consideration of metabolic and cardiovascular risk factors in COPD management as well as previous findings indicating that COPD is not just a pulmonary disease, but also a systemic inflammatory disorder with far-reaching metabolic implications. Indeed, past

literature has also consistently reported that dyslipidemia is common among patients with COPD. Another large population-based study carried out in China, found that there was a significant increase in the mean total cholesterol and LDL levels among COPD patients than controls of their respective age [10]. Likewise, one study study carried out by Gann et al. concluded that systemic inflammation in COPD was linked to an increase in the concentrations of serum lipids implying that changes in lipids could serve as an indicator of low-grade persistent inflammation [11]. Our data goes in line with these observations, especially the high positive correlation between LDL-C and COPD severity. Decreased levels of HDL-C, which we observed in our patients, have been identified in several studies. Decrier et al. provided evidence that COPD patients had considerably low HDL value than their controls did, and the changes in HDL were associated with systemic inflammation, as well as cardiovascular events in a European cohort [12]. HDL has protective properties based upon both reverse cholesterol transport and anti-inflammatory response; a decrease in HDL can therefore impact cardiovascular pathology and exacerbate poor pulmonary outcomes in COPD patients. This corresponds to the data that HDL was <40 mg/ld. in 60% of patients in severe/very severe groups in our data. In our sample of severe COPD patients, 40% had triglycerides >150 mg/LD. This is similar to a study done in India, in which raised triglycerides were much more prevalent in patients with GOLD III and IV disease [13]. The trends found by another cross-sectional study, conducted in Saudi Arabia, are similar because the study indicated that hypertriglyceridemia has a close connection to the prevalence of COPD, especially in older men who have a history of smoking [14]. In conjunction with our results, these data provide bias against the view that triglyceride deregulation is a significant metabolic factor in pathophysiology of COPD in Middle Eastern populations. Lipid peroxidation in COPD Systolic and cardiovascular inflammation are characteristic of chronic obstructive pulmonary disease (COPD), and they enhance the oxidative peroxidation of lipids, altering the physiology of their lipoproteins [15]. Furthermore, hepatic synthesis of lipids and changes in the metabolism of lipoproteins could be triggered by hypoxia in severe COPD, in addition to raising the serum concentration of cholesterol and triglycerides [16]. Alternatively, chronic sustained systemic corticosteroid exposure may also be involved in the pathogenesis of lipid abnormalities in COPD patients, but as none of the subjects participating in our study were receiving lipid-lowering drugs, pharmacologic confounding by this factor should be eliminated. Cardiovascular comorbidities continue to be the most frequent cause of mortality in COPD and dyslipidemia is a risk factor that can be improved. Muller ova et al. conducted another study that showed a nearly two-fold increase in cardiovascular events in the patients with abnormal lipid profile than those who did not have abnormalities [17]. The results of our study showing that lipid abnormalities actually get worse as severity of COPD increases supports the importance indeed of cardiovascular risk proactive measurement and management in this population. In an interesting turn of events, conflicting results have been recorded in some studies. COPD patients can experience weight loss and decreased levels of BMI and lipids to systemic wasting and catabolism, a cohort study of Japanese patients indicated [18]. Nevertheless, this variation can be connected with the peculiarities of the population, nutrition and predisposition. Most of the patients in our sample were overweight or could be classified as having a normal BMI, which might be one of the reasons why dyslipidemia developed with advanced stages of the disease. Our study has large clinical implications. Although COPD treatment is associated with improved lung function and minimization of exacerbation, our results support the idea of including metabolic screening tests as a standard procedure. Lipid abnormality screening, specifically of LDL and HDL, might enable clinicians to detect patients at high risk who could then be offered preventative treatment at an early stage through lifestyle change or a lipid-lowering agent. The holistic paradigm can not only diminish cardiovascular morbidity but also possibly inhibit systemic inflammation that enhances the advances of COPD [19].There are limitations to our study. Due to their cross-sectional nature, causality cannot be determined, and, therefore, longitudinal investigations are necessary to determine whether dyslipidemia is a factor that can hasten the process of COPD or only represents a comorbidity. Also, patterns of nutrition, physical exercise and socioeconomic aspects, which are capable of affecting lipid

metabolism, were not measured in our study. Notwithstanding these limitations, our findings contribute to the growing body of evidence linking metabolic deregulation with severity of Coding brief, our results support those of previous studies but also introduce evidence regarding the UAE context, where both COPD and metabolic syndrome continue to increase. The presented correlation between COPD severity and lipid abnormalities is important in illustrating the need to take on a multidisciplinary approach to caring about patients, where pulmonary rehabilitation is coupled with cardiovascular and metabolic risk-management strategies. Prospective longitudinal and interventional studies are also needed to investigate whether correction of dyslipidemia would translate into a benefit in COPD and overall mortality [20].

CONCLUSION

It is indicated in this study that dyslipidemia has an important correlation with the severity of COPD. High total and LDL and triglycerides and low HDL were common in moderate-severe cases. These results indicate that both pulmonary and metabolic approaches should be involved in COPD management in terms of paying attention to the lipid profile assessment to minimize the risk of cardiovascular events and increase patient outcomes.

LIMITATIONS

The limitation of our study is a cross-sectional one, which does not allow inferring the causality. Generalizability is limited by the small size of the single-center sample. Lifestyle issues like diet, exercises and socioeconomic status that can have an implication to how the body processes lipids were not established. These associations must be confirmed with longitudinal studies.

FUTURE DIRECTIONS

Prospective, metacentric study in a bigger population should be conducted in the future and confirm the findings. Interventional studies examining the possibility of lipid-modifying treatment on the basis of improvement of COPD are justified. It may also be additionally suggested that genetic, nutritional, and environmental factors that are involved in lipid metabolism can be investigated in the identification of the aspects that contribute more to the understanding of the relationship between dyslipidemia and the development of COPD and cardiovascular diseases.

ABBREVIATIONS

1. **COPD** – Chronic Obstructive Pulmonary Disease
2. **LDL-C / LDL** – Low-Density Lipoprotein Cholesterol
3. **HDL-C / HDL** – High-Density Lipoprotein Cholesterol
4. **TG** – Triglycerides
5. **GOLD** – Global Initiative for Chronic Obstructive Lung Disease
6. **FEV_1** – Forced Expiratory Volume in 1 Second
7. **FVC** – Forced Vital Capacity
8. **BMI** – Body Mass Index
9. **SD** – Standard Deviation
10. **SPSS** – Statistical Package for the Social Sciences
11. **UAE** – United Arab Emirates
12. **IRB** – Institutional Review Board

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Authors Contribution

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Drafting:Mohammad Kamran

Data Analysis: Khalil

Critical Review:Izhar Ahmad

Final Approval of version: All authors contributed significantly to the study's conception, data collection, analysis, Manuscript writing, and final approval of the manuscript as per **ICMJE Criteria**.

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