

Original Article

A study of relationship between lipid profile and severity of SARS-CoV-2

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Abstract

COVID-19 is a severe acute respiratory disease caused by coronavirus 2. While many biochemical alterations have been studied in patients with COVID-19, only a few studies were available to explore the relationship between serum lipid profile values and the severity of SARS COVID-19 infection. A cross-sectional study was conducted at Chettinad Hospital and Research Institute on 128 patients infected with SARS COVID-19 from March 2020 to September 2020. It was an age and sex-matched study. Patients were categorized into mild and severe based on the signs and symptoms. A fasting serum lipid profile and IL-6 levels were measured and Pearson's correlation analysis was done. There was a highly significant decrease in the median and IQR levels of TC, HDL, and LDL in severe cases as compared to mild cases [TC – mild: (256,64), severe (125,44), HDL – mild (46,11), severe (25,13), and LDL – mild (170,48), severe (76,36)]. TGL showed a significant decrease [mild: (170,67), severe:(110,69)]. IL-6 showed a significant increase in severe cases when compared to mild cases [mild:(20,37), severe:(62,105)]. Pearson's correlation analysis showed a significant inverse relationship between the levels of TC, HDL, and IL-6. However, TGL and LDL showed inverse but no significant relationship with IL-6. As the severity of COVID-19 increases, lipid profile levels start decreasing. Hypolipidemia is a pathognomic finding in severe SARS COVID-19 infection.

Keywords: hypolipidemia, lipid profile and Interleukin 6.

Introduction

A new coronavirus called SARS-CoV-2 (Severe Acute Respiratory Distress Syndrome) causes COVID-19 infection [1, 2]. The COVID-19 pandemic exhibits a highly variable presentation. Some patients experience only mild symptoms, while others progress to severe acute respiratory distress [3].

COVID-19 is a highly inflammatory condition in which the cytokine cascade causes multiple organ lesions [4]. IL-6, one of the key cytokines, appears to be raised in the circulation of severe cases of COVID-19 patients [5].

The disease spreads rapidly, affecting several people and causing millions of deaths. Hence, the World Health Organization (WHO) has referred to COVID-19 as a pandemic.

Previous studies have shown that total cholesterol serum levels are lower than in normal subjects [6]. A major component of SARS-CoV-2 is lipid. They are important in the host cell's viral membrane fusion [7]. During the early stages of the infection, cholesterol and lipid rafts play a major role [8]. Cholesterol is not only involved in viral replication and internalization but also activates the immune system [9].

Association of dyslipidemia with SARS-CoV-2 has been rarely reported. Only a few studies have reported the association of dyslipidemia with the severity of COVID-19 infection. Hence the present study aimed to investigate the levels of lipid profile and IL-6 in mild and severe cases of COVID-19 infection and then correlate the lipid profile levels with the severity of the disease.



Material and methods

Study design and patients

The present study was done at Chettinad Hospital and Research Institute from March 2020 to September 2020. A total of 128 COVID-19-positive patients who were hospitalized were included in the study. Patients were categorized as mild (n=70) and severe (n=58) based on clinical management protocol: COVID-19 issued by the Government of India, Ministry of health and family welfare – the Directorate General of Health Services.

Mild cases

Clinical presentation: patients with uncomplicated upper respiratory tract infections may develop mild symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache, and pneumonia without signs of serious illness.

Clinical parameters: Without evidence of breathlessness or hypoxia (normal saturation), adolescent or adult with the presence of clinical features of dyspnea and or hypoxia, fever, cough, including SpO₂ between 90 and 94%, a respiratory rate of more than or equal to 24 per minute

Severe cases

Clinical presentation: patients with severe pneumonia. Clinical parameters: adolescent or adult with clinical signs of pneumonia plus one of the following: respiratory rate >30 breaths/min, severe respiratory distress, SpO₂ <90%

The present study was a cross-sectional study conducted after getting approval from the Institutional Human Ethics Committee. It was an age and sex-matched study. A semi-structured questionnaire was used to extract the epidemiological and demographic data from the patients. A detailed history followed by a general and systemic review was carried out. Pneumonia was diagnosed based on the guidelines recommended by the Indian Chest Society (ICS) and the National College of Chest Physicians of India (NCCP).

Laboratory data collection

A 5 ml fasting venous blood sample was collected from all patients through standardized procedures. Serum Lipid profile which includes total cholesterol (TC) in mg/dl, triglycerides (TGL) in mg/dl, high-den-

sity lipoprotein (HDL-C) in mg/dl and low-density lipoprotein (LDL-C) in mg/dl were measured using Siemens Dimension RxL Max automated chemistry analyzer and interleukin 6 (IL-6) in pg/ml was measured using Unicel DXI 600 Immunoassay System based on chemiluminescence technique.

Statistical analysis

SPSS software was used to perform statistical analysis. Continuous variables were expressed as the median and interquartile range. An unpaired student's t-test was used to determine the significant difference between the mild and severe cases of COVID-19 patients. A Pearson's correlation coefficient was used to measure the statistical relationship between lipid profile and IL-6.

Results

The present study showed highly significant decrease in the median and interquartile range of total cholesterol in (mg/dl), high-density lipoprotein in (mg/dl), and low-density cholesterol (in mg/dl) in severe cases as compared to mild cases of COVID-19 patients. Triglycerides showed a significant decrease in the median and interquartile range in severe cases compared to mild cases of COVID-19 patients. IL-6 showed a significant increase in severe cases when compared to mild cases (Table 1). Pearson's correlation analysis showed a significant inverse relationship between the levels of TC, HDL, and IL-6. However, TGL and LDL showed inverse but no significant relationship with IL-6 (Figure 1).

Discussion

Our study analyzed the median and IQR values of the lipid profile and IL-6 in mild and severe cases of COVID-19 patients. The serum levels of TC, TGL, HDL, and LDL decreased in severe cases compared to mild cases. It may be due to the various pathological complications induced by the COVID-19 infection. Impairment of immune function and exaggerated inflammatory response are the cardinal features of severe covid infection [10–12]. In addition, in patients with severe COVID-19, deregulated lipid metabolism was demonstrated in the analysis of proteomes [13]. As the severity of the infection increases, hypolipidemia occurs. This

Table 1: Descriptive statistics of the variable in mild and severe COVID-19 patients.

Variables	COVID-19 patients		P-value
	Mild Median(IQR)	Severe Median(IQR)	
Age in years	59 (38–67)	60 (53–68)	p=0.0229*
TC (mg/dl)	256 (211–275)	125 (105–149)	p<0.0001
TGL (mg/dl)	170 (140–207)	110 (75–144)	p=0.0187*
HDL-C (mg/dl)	46 (44–55)	25 (21–34)	p<0.0001*
LDL-C (mg/dl)	170 (137–185)	76 (65–101)	p<0.0001*
IL-6 (pg/ml)	20 (15–52)	62 (16–121)	p=0.0458*

Note: * – P-value<0.05 (significant). TC – Total Cholesterol; TGL – Triglycerides; HDL-C – High-Density Lipoprotein Cholesterol; LDL-C – Low-Density Lipoprotein Cholesterol; and IL-6 – Interleukin-6.

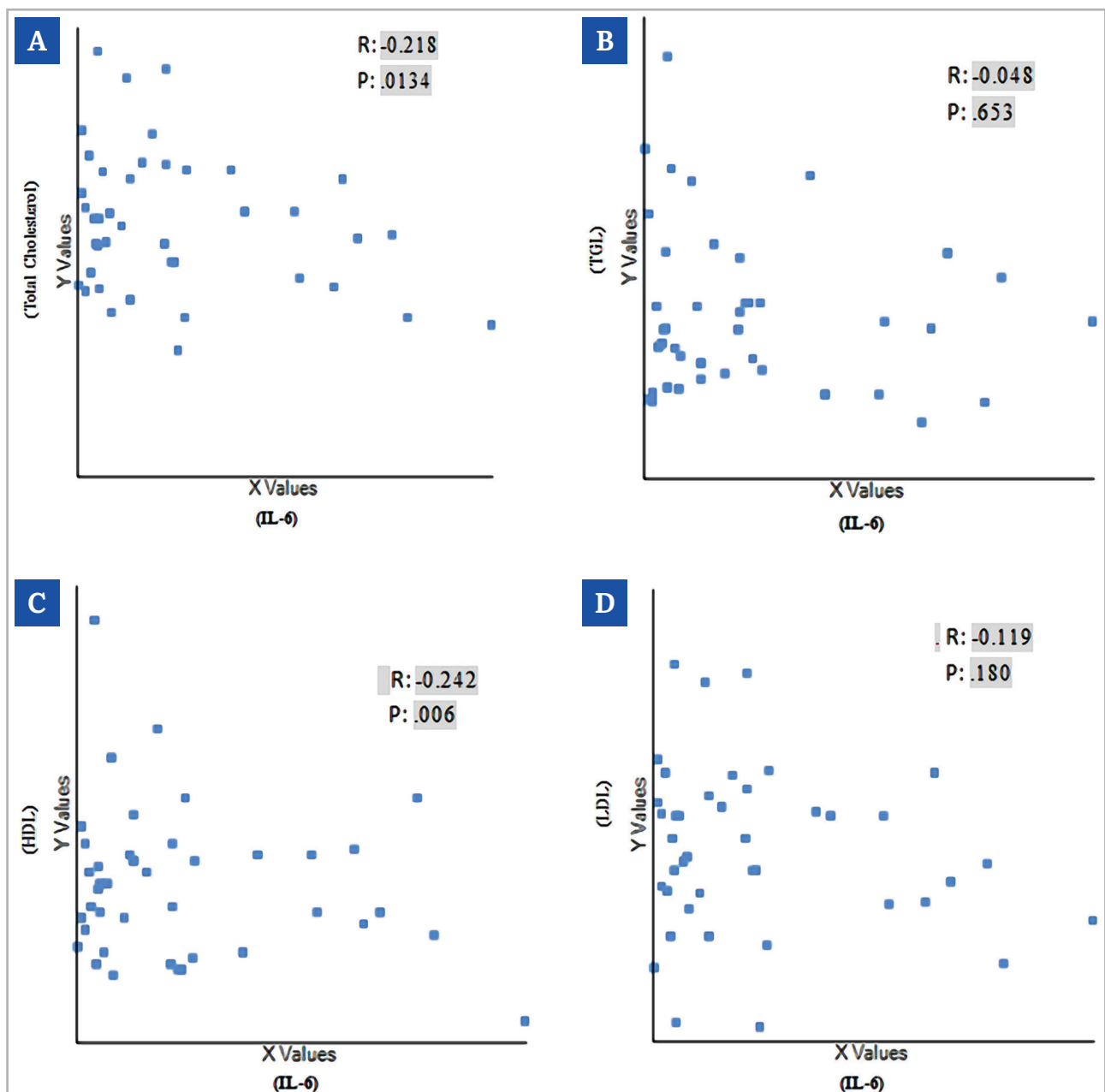


Figure 1: Pearson's correlation analysis between Serum IL-6 and Lipid profile values. p<0.05 – Significant.

will give the treating doctors a clue of disease severity so that further progression of the disease can be halted by giving vigorous urgent treatment to COVID-19 patients.

Various mechanisms have been explained for this picture of dyslipidemia in severe covid infection cases. During the infection, severe inflammation develops. Therefore, pro-inflammatory cytokines such as TNF- α , IL-6 and IL-1 β are released, impairing liver function and reducing cholesterol efflux and transport, resulting in dyslipidemia [14]. Hence IL-6 is considered as one of the major contributors to dyslipidemia.

There is an increase in free radical production in coronavirus-infected host cells. These toxic free radicals tend to degrade lipid molecules [15]. COVID-19 infection increases vascular permeability. Hence, cholesterol will leak into tissues like alveolar spaces. This forms intra-alveolar exudates, which cause lung pathology in covid patients [16, 17].

Dyslipidemia will increase platelet activity, thereby causing endothelial dysfunction and thrombotic complications [18]. As a result, dyslipidemia is a contributor to the severity of the disease in patients with COVID-19.

Limitations of the study

The sample size used in the study was small. A large cohort study is required to monitor the changes in the lipid profile levels during the entire course of the disease in COVID-19 patients.

Conclusion

As COVID-19 infection increases in severity, hypolipidemia develops, which is evident in this study. These new insights will certainly help physicians intervene in a timely manner and therefore reduce mortality and morbidity in patients with SARS-CoV-2.

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Author's contribution: Dr. Anuradha designed the study, collected and interpreted data, and wrote the manuscript. Dr. Santhini and Dr. Sumathy contributed to data collection and manuscript.

Conflict of interest

The authors declare no conflict of interest.

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