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Quantitative relation of Triglyceride/High-Density Lipoprotein Cholesterol correlated with Covid-19 Mortality: A Retroactive study in Bihar

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Abstract

Aim: the aim of the study was to explore the inflammatory associations between the TG/HDL-c magnitude relation and COVID-19 prognosis.

Methods: A complete of 131 COVID-19 patients consisting of 122 survivors and nine non-survivors were retrospectively investigated. The clinical options and baseline hematologic parameters were recorded and analyzed in predicting the mortality of COVID-19

Results: Compared with the survivors, the non-survivors of COVID-19 had considerably higher levels of white blood cells (4.5 vs 13.5 × 109/L; P < zero.001), neutrophils (3.1 vs 11.9 × 109/L; P < zero.001), C-reactive proteins (15.6 vs 76.5 mg/L; P < zero.001) and TG/HDL-c magnitude relation (1.3 vs 2.5; P = 0.001). Steered that the TG/HDL-c magnitude relation might predict the mortality of COVID-19.

Conclusion: Our study incontestable that TG/HDL-c magnitude relation may probably be a prophetical marker for mortality in COVID-19 patients.

Keywords: COVID-19, lipid, high density conjugated protein sterol(HDL) , inflammation, infection, triglyceride-to-high-density conjugated protein sterol magnitude relation, mortality

Introduction

As is usually well-known, Coronavirus sickness 2019 (COVID-19), caused by severe acute metastasis syndrome coronavirus a pair of (SARS-CoV-2), has already become a significant threat to the world public health system.1 it's a lot of contagious than {sars|severe acute metastasis syndrome|SARS|respiratory disease|respiratory illness|respiratory disorder} and Near East respiratory syndrome, each of that ar from constant family of RNA virus as COVID-19.2 Despite a comparatively higher incidence of delicate cases, once it gets worse, severe cases will progress apace, culminating in metastasis failure, septic shock or a fatal outcome. during this regard, it's of nice significance to spot relevant risk factors for COVID-19 progression. beyond question, dyslipidemia is powerfully related to blubber and obesity-related disorders, and is usually found in patients with stroke, hypoglycemic agent resistance, metabolic syndrome and vas diseases.3–6 Over recent years, corpulent state has been characterised by aerophilous stress.7 it had been reportable that hypertrophied adipocytes, that promoted the disfunction of animal tissue, may turn out a high level of reactive atomic number 8 species (ROS), collaborating in several metabolic signal pathways, like hypoglycemic agent sensitivity, inflammation, and epithelium disfunction. Meanwhile, inflammation could lead on to a fast spike in levels of ROS, that established a feedback-loop between inflammation and aerophilous stress.7 Increase in lipid (TG) and reduce in high density conjugated protein sterol (HDL-c) is also caused by inflammatory cytokines, and it's been instructed that lipid to high density conjugated protein sterol quantitative relation (TG/HDL-c ratio), a simple, non-invasive, and convenient measure indicator, may integrate prognostic risks of 2 parameters into one risk issue and showed higher prognostic worth than TG and HDL-c alone in hardening of the arteries disturbances,8

Materials and Methods

The study was conducted by Nalanda Medical faculty & Hospital, Patna in Gregorian calendar month 2021, 311 COVID-19 patients were all adults UN agency were confirmed by period of time enzyme chain reactions from Nalanda Medical faculty & Hospital, Patna. Among the patients, one hundred eighty of them whose lipids check was missing were excluded. Thus, 131 patients were listed within the study. moreover, listed patients were divided into survivor cluster and non-survivor cluster supported their survival standing. To avoid the impact of underlying diseases on COVID-19, forty four patients with high blood pressure, upset, diabetes, COPD, bronchitis, vessel sickness, or cancer were excluded, and any studies were conducted to analyze the role of TG/HDL-c quantitative relation in COVID-19 with no underlying diseases. Considering the non-normal distribution of all continuous variables, these knowledge were given as Median with interquartile vary, and Mann–Whitney check was accustomed compare the distinction between teams. IBM SPSS version twenty six software system (IBM®SPSS, Chicago, IL, USA) was conducted throughout all analyses.

Results

The registered patients were separated into survivors and non-survivors supported clinical outcomes, and demographics and baseline characteristics for every cluster area unit provided in Table one. a complete of 131 patients aged on top of eighteen were admitted to the study, including 122 survivors and nine non-survivors. supported their age, patients were additional divided into 3 teams, ie, ≥ sixty five years (21.4%), forty five years ≤ age < sixty five years (36.6%), and < forty five years(42.0%). examination the survivors with the non-survivors, there have been important variations within the ages and comorbidities with cancer (P < zero.05).

	No. (%) Total (n = 131)	Survivor (n = 122)	Non-Survivor (n = 9)	P value
Age, %				<0.001
≥65y	28 (21.4)	22 (18.4)	6 (66.6)	
45≤age<65	48 (36.6)	45 (36.9)	3 (33.4)	
<45y	55 (42.0)	55 (45.1)	0	
Gender, %				0.774
Male	68 (51.9)	64 (52.5)	5 (55.6)	
Female	63 (48.1)	58 (47.5)	4 (44.4)	
Symptoms				
Fever, %	102	8 (67.6)	8 (88.9)	0.060
Cough, %	(78.6)	9 (80.7)	7 (83.3)	0.787
Myalgia, %	105	12 (10.2)	1 (11.5)	0.521
Fatigue, %	(80.9)	5 (44.7)	2 (27.8)	0.164
Headache, %	12 (9.9)	15 (13.1)	1 (11.6)	0.352
Diarrhoea, %	56 (43.5)	26 (22.1)	2 (22.2)	0.993
Abdominal	16(12.6)	3 (2.9)	0 (0.0)	0.467
pain, %	28 (22.1)	4 (34.0)	3 (38.9)	0.675
Shortness of	3 (2.7)			
breath, %	44 (34.3)			
Comorbidities		24 (19.7)	2 (27.8)	0.410
Hypertension,%		7 (6.1)	1 (16.7)	0.089
Cardiovascular	26(20.2)			
disease, %	9(6.9)	11 (9.4)	1 (11.1)	0.815
Diabetes, %		0 (0.0)	0 (0.0)	0.786
COPD, %	12 (9.5)	9 (8.1)	0 (0.0)	0.527
Chronic-	0.0			
bronchitis, %	9 (7.6)	3 (3.2)	1 (11.2)	0.609
Cerebrovascular				
disease, %	4 (3.4)	1 (1.0)	1 (16.7)	<0.001
Cancer, %	2 (1.9)			

Table 1: Demographics and Baseline Characteristics of Survivor and Non-Survivor of COVID-19

Notes: *P* values indicate differences between survivor and non-survivor of COVID-19 patients. *P*< 0.05 was considered statistically significant.

The non-survivor COVID-19 patients had significantly higher white blood cells (WBC) (4.5 vs 13.5 ×109/L; *P*<0.001), neutrophils (3.1 vs 11.9 ×109/L; *P*<0.001), C-reactive proteins (CRP) (15.6 vs 76.5mg/L; *P*<0.001), and TG/HDL-c ratio (1.3 vs 2.5; *P*=0.001) levels than survivors, but the levels of lymphocytes (1.2 vs 0.6 ×109/L; *P*<0.001), and low density lipoprotein cholesterol-to-high-density lipoprotein cholesterol ratio (LDL-c/HDL-c) (3.4 vs 2.3; *P*=0.010) were lower in non-survivors when compared with survivors (Table 2).

	Survivor	Non-Survivor	*P* value
WBC, ×109/L	4.5 (3.6–6.0)	13.5 (7.8–	<0.001
Lymphocytes,	1.2 (0.8–1.5)	17.8)	<0.001
×109/L	3.1 (2.2–3.8)	0.6 (0.4–0.7)	<0.001
Neutrophils,	15.6 (4.5–	11.9 (6.9–	<0.001
×109/L	35.3)	16.6)	0.899
CRP, mg/L	4.5 (3.8–5.6)	76.5 (36.8–	0.010
TC/HDL-c ratio	3.6 (2.5–4.1)	229.0)	0.001
LDL-c/HDL-c	1.3 (0.9–2.1)	5.0 (3.4–5.6)	
ratio		2.2 (1.4–3.4)	
TG/HDL-c ratio		2.5 (1.5–4.8)	

Table 2: Comparison of Laboratory Parameters Between the Survivor and Non-Survivor of COVID-19 Patients

Notes: *P* values indicate differences between survivor and non-survivor of COVID-19 patients. *P*<0.05 was considered statistically significant.

Abbreviations: COVID-19, Coronavirus disease 2019; WBC, White blood cells; CRP, C-reactive proteins; TC/HDL-c ratio, total cholesterol-to-high-density lipoprotein cholesterol ratio; LDL-c/HDL-c ratio, low-density lipoprotein cholesterol-to-high-density lipoprotein cholesterol ratio; TG/HDL-c ratio, triglyceride-to-high-density lipoprotein cholesterol ratio.

The mortality of COVID-19 patients was associated with age [odds ratio (*OR*) = 1.108; 95% *CI*, 1.060–1.159; *P* < 0.001], cancer (*OR* = 24.200; 95% *CI*, 3.754–156.023; *P* = 0.001), WBC (*OR* = 1.451; 95% CI, 1.267–1.661; *P* < 0.001), lymphocytes (*OR* = 0.006; 95% *CI*, 0.001–0.059; *P* < 0.001), neutrophils (*OR* = 1.493; 95% *CI*, 1.294–1.724; *P* < 0.001),CRP (*OR* = 1.023; 95% *CI*, 1.014–1.032; *P* < 0.001), LDL-c/HDL-c ratio (*OR* = 0.551; 95% *CI*, 0.327–0.927; *P* = 0.025), and TG/HDL-c ratio (*OR* = 1.291; 95% *CI*, 1.066–1.564; *P* = 0.009) (Table 3).

	Odds Ratio (95% CI)	P value
Age	1.108 (1.060–1.159)	<0.001
Cancer	24.200 (3.754–156.023)	0.001
WBC	1.451 (1.267–1.661)	<0.001
Lymphocytes	0.006 (0.001–0.059)	<0.001
Neutrophils	1.493 (1.294–1.724)	<0.001
CRP	1.023 (1.014–1.032)	<0.001
LDL-c/HDL-c ratio	0.551 (0.327–0.927)	0.025
TG/HDL-c ratio	1.291 (1.066–1.564)	0.009

Table 3: Univariate Analysis of Risk Factors Related to the Mortality of COVID-19 Patients.

Notes: P values indicate differences between the survivor and non-survivor COVID-19 patients. *P* < 0.05 was considered statistically significant.

Abbreviations: COVID-19, Coronavirus disease 19; CI, confidence interval; WBC, White blood cells; CRP, C-reactive proteins; LDL-c/HDL-c ratio, low-density lipoprotein cholesterol-to-high density lipoprotein cholesterol ratio; TG/HDL-c ratio, triglyceride-to-high-density lipoprotein cholesterol ratio.

However, only TG/HDL-c ratio (*OR* = 1.730; 95% *CI*, 1.044–2.866; *P* = 0.033) and cancer (*OR* = 44.973; 95% *CI*, 2.059–982.524; *P* = 0.016) were the independent risk factors affected mortality in COVID-19 patients (Table 4).

	B	SE	Wald	P	OR	95 % CI
Age	0.050	0.039	1.703	0.192	1.052	0.975-
Cancer	3.806	1.574	5.851	0.016	44.973	1.134
WBC	0.919	1.322	0.484	0.487	0.399	2.059-
Lymphocytes	3.388	2.375	2.035	0.154	0.034	982.524
Neutrophils	1.055	1.358	0.604	0.437	2.872	0.030-
CRP	0.007	0.007	1.113	0.292	1.007	5.319
LDL-c/HDL-c ratio	0.323	0.307	1.111	0.292	0.724	0.000- 3.550
TG/HDL-c ratio	0.548	0.258	4.522	0.033	1.730	0.201- 41.096
						0.994- 1.021
						0.397- 1.321
						1.044- 2.866

Table 4: Multivariate Analysis of Risk Factors Related to the Mortality of COVID-19 Patients.

Notes: P values indicate differences between the survivor and non-survivor COVID-19 patients. *P* < 0.05 was considered statistically significant (marked in bold).

Abbreviations: COVID-19, Coronavirus disease 19; SE, standard error; OR, odds ratio; CI, confidence interval; WBC, White blood cells; CRP, C-reactive proteins; LDL-c/ HDL-c ratio, low-density lipoprotein

cholesterol-to-high-density lipoprotein cholesterol ratio; TG/HDL-c ratio, triglyceride-to-high-density lipoprotein cholesterol ratio.

Discussion

Our study according 3 findings primarily. Firstly, there was an increase in TG/HDL-c magnitude relation of the non-survivors when put next thereupon of the survivors. Secondly, TG/HDL-c magnitude relation levels in patients on admission were completely correlative with inflammatory indicators, like white corpuscle, neutrophils, and CRP. Finally, TG/HDL-c magnitude relation in patients on admission may well be able to predict and live COVID-19 mortality. it's been verified that TG levels would possibly increase throughout infection and inflammation.15,16 Inflammatory cytokines would possibly contribute to TG synthesis and scale back TG chemical reaction underneath septic conditions,17 and will additionally increase the angiopoietin-like macromolecule four expressions which may additional suppress TG-rich conjugated protein metabolism.18 no doubt, because of social isolation and long amount of reside home, individuals were at risk of have associate degree unbalanced diet and be less active, which could additional worsen their metabolic and supermolecule profiles to induce hypertriglyceridemia eventually.19 Hypertriglyceridemia will cause epithelium disfunction, therefore resulting in the next status to complications associated with vas diseases in COVID-19 patients.20 what is more, TG might regulate the expression of angiotensin-converting enzyme-2 (ACE2) macromolecule through methylenetetrahydrofolate dehydrogenase (MTHFD1) that affected the methylation of the ACE2.21 in the meantime, it had been according that TG was related to the excessive activation of macrophages,22 positive with the amount of CRP and procalcitonin,23 and also the level was considerably exaggerated in COVID-19 patients with poor prognoses.24 the foremost putting perform of HDL is to facilitate reverse steroid alcohol transport from tissues to the liver.25 HDL particles area unit crucial for the system and defense against infectious diseases, which may mitigate inflammatory responses throughout infection,26,27 and performance against RNA and desoxyribonucleic acid viruses.28 additionally, HDL has the best affinity for binding and neutralizing lipopolysaccharides and lipoteichoic acid,29 and additionally exerts antithrombotic30 and inhibitor effects.31 victimization genetic variants as risk factors, a previous analysis known that genetically determined exaggerated levels of

HDL-c exhibited associate degree association with reduced mortality from infection.16 At an equivalent time, it had been advised that a genetic variant in cholesteryl organic compound transfer macromolecule (CETP), was associated with the extent of HDL-c in septic patients,32 and CETP matter may well be a possible medical care for infection.33 Some infectious agent infections inflicting inflammation additionally resulted in dyslipidemia, within which HIV patients had a small HDL-c levels,34,35 and patients with serum hepatitis within the liver disease part showed lower HDL-c levels.36 Recently, it's been according that COVID-19 patients with declined HDL-c concentrations had longer time for infectious agent macromolecule amplification take a look at turning negative than those with traditional levels,37 associate degreed lower HDL-c levels exhibited an association with the severity of COVID-19 in patients.38 in sight of the on top of, it's been well documented that there could also be a marked decrease in HDL-c concentrations throughout the acute

part response, however, the mechanisms underlying this decrease don't seem to be clearly outlined. Apolipoprotein A1 (ApoA-1), a serious structural macromolecule of HDL-c, was according to be small beside lower HDL-c once pro-inflammatory cytokines (eg, IL-6 and CRP) strangled the activity of apolipoprotein synthesis enzymes.24,27 body fluid amyloid A (SAA)-enriched HDL displaced and small ApoA-1 levels, and scavenged HDL earlier, that was considerably higher in patients diagnosed with severe COVID-19.17,24 Paraoxonase one (PON1), associate degree inhibitor protein of HDL, might be inactivated underneath aerophilic stress and additional weaken HDL functions.39 what is more, hemodilution, consumption of HDL particles, and capillary leaks might additionally justify the small HDL concentration, all of which could be applicable for COVID-19 patients.27,40 additionally, impaired inhibitor properties of HDL might cause supermolecule chemical reaction, thence causation inflammation and accentuating tissue injury.20 Consequently, HDL-c deficiency will induce protein production, and these overproduced cytokines will successively prime the depletion of HDL-c, therefore promoting a vicious circle in severe patients. jointly, general inflammatory responses will cause hypertriglyceridemia and reduce HDL-c, leading to a rise in TG/HDL-c magnitude relation. Inflammatory cells will accelerate the discharge of assorted cytokines within the pathophysiological method throughout SARS-CoV-2 infection, therefore resulting in a protein storm which will induce speedy development in multiple organ dysfunctions or maybe death.41 superabundant proof within the past has indicated that there was a powerful association of compromised immune functions and excessive inflammatory response with mortality from COVID-19.42–44 within the current study, the TG/HDL-c magnitude relation was completely associated with the amount of white corpuscle, neutrophils, and CRP. These findings were kind of like the study mentioned that IPAH patients with elevated TG/HDL-c magnitude relation had elevated levels of IL-1β, MCP-1, and IL-6.10 In our additional analysis, a mythical creature curve and metric linear unit curve were generated with the invention that TG/HDL-c magnitude relation was most likely another prognostic predictor for COVID-19. supported the findings bestowed on top of, it may be speculated that inflammation observation may well be helpful in predicting the mortality of COVID-19 patients UN agency had elevated TG/HDL-c magnitude relation. Anyway, additional investigations area unit needed for the elaboration of specific mechanisms of TG/HDL-c magnitude relation on COVID-19. The study still has some limitations. First, because of the retrospective analysis, relevant variables (eg, BMI) weren't known in our study and also the little sample size of survivors, which could cause bias. Next, the time patients having lipids tests was in several part of COVID-19 infection for the rationale of earlier or later onset of symptoms to enter the hospital that might additionally build a bias. Third, there's not a public information providing biomarkers before patients suffered diseases, which could build the analysis additional convincing. Fourth, there was no additional detection of TG and HDL-c levels in patients throughout hospitalization. Dynamic observation may well be a much better characterization for dyslipidemia. Finally, supermolecule metabolism may be tormented by numerous factors, like dietary preferences and habits, and also the mechanisms ought to be additional studied.

Conclusion

To sum up, our study advised that higher TG/HDL-c magnitude relation would possibly profit the identification of COVID-19 patients UN agency had a high probability of developing an occasional survival. Therefore, rigorous management of supermolecule parameters is important throughout COVID-19 pandemic, and treatment with TG-lowering or HDL-raising agents might improve the prognosis of COVID-19. giant sample, multi-center prospective studies and pathophysiological mechanisms connected lipids and COVID-19 ought to be performed within the future.

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