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Original Article

Assessment of lipid profile in cardiovascular diseases patients with toxoplasmosis in Kirkuk governorate, Iraq

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ABSTRACT

The current study aimed to assess lipid profile in cardiovascular patients with toxoplasmosis in Kirkuk Governorate. A total of 150 subjects diagnosed with cardiovascular disease at Azadi Teaching Hospital and Kirkuk Teaching Hospital from September 2023 to January 2024 were enrolled, along with 30 healthy volunteers. Total of 150 blood samples collected from cardiovascular disease (CVD) patients included in the study showed that 45(30%) were IgG positive. While 12(8%) was IgM positive, the overall anti-*T. gondii* IgG and IgM seropositivity was found to be 5(3.3%) in patients who had CVD. Total cholesterol, triglyceride LDL, VLDL showed a significant (P≤0.05) increase in patients and in those with both CVD and Toxoplasma. HDL showed a significant (P≤0.05) decrease in CVD and CVD patients and in those with both CVD and Toxoplasma Based on the results of the current study, an association was found between cardiovascular diseases and lipid profiles. On the other hand, *Toxoplasma gondii* infection leads to dyslipidemia in patients.

Keywords: *CVD, T. gondii, Lipid profile, Cholesterol*

Introduction

One of the most parasite affecting humans and other warm-blooded animals worldwide is *Toxoplasma gondii* [1-2]. Approximately one-third of human populations worldwide are infected with toxoplasmosis [3-4], with infection rates ranging from 30% to 50% in the Middle East [5]. Cats and other Felidae are the definitive host, whereas humans, birds, and other mammals serve as the asexual intermediate host [6]. Cardiovascular disease accounts for around 30 % of deaths globally. Moreover 50% of heart fatalities are caused by coronary artery disease [7]. However, myocarditis, pneumonitis, encephalopathy, polymyositis, or hepatitis are unusual side effects of *T. gondii*. The transmission from mother to fetus is the most severe form of infection [3]. The development of toxoplasmic chorioretinitis can occur through congenital infection or reactivation [8]. Toxoplasmosis can be fatal in persons with impaired immune systems due to the reactivation of a long-term infection [9]. Acute heart failure, pericarditis, pericardial and other cardiac damage may be linked to *T. gondii* infection [10-11].

The World Health Organization (2023) estimates that cardiovascular diseases (CVDs) account for 17.9 million fatalities yearly, or 32% of all deaths worldwide, the seroepidemiology of T. gondii infection in cardiovascular patients is not well covered in the literature currently in publication [12].

Materials & Methods

Patients

A total of 150 subjects diagnosed with cardiovascular disease in Azadi Teaching Hospital and Kirkuk Teaching hospital from September 2023 to January 2024 were used. Experimental work was carried out at private Laboratories in Kirkuk, Iraq. 30 healthy volunteers without any diseases were also taken as a control group.

Sample collection

A volume of blood of 5 ml blood was obtained using sterile syringe from each patient and blood sample were placed into sterile gel tubes. The blood was separated by centrifuging it for 5-10 minutes at 3000 rpm. The serum was then divided into four Eppendorf tubes and stored in a deep freezer (-20 C) until it was needed.

Ethical approval

According to the native ethics group, the study protocol was approved, and all patients who participated gave informed permission and provided information about the study's goal.

Detection of Toxoplasma IgG and IgM by ELISA

It tracks any complex including antigen and antibody couples. The measurements were performed by IgG/ELISA kit (Sun-Long BIOTECH, China) and IgM/ELISA kit (Sun-Long Biotech, China).

Measurements of lipid profile by Cobas

The enzymatic cholesterol, triglycerides and HDL assay as described by Eggstein and Kreutz still required saponification with potassium hydroxide. Roche/Hitachi cobas systems automatically calculate the analyte concentration of each sample. Statisticians used Excel 2003 and the SPSS 15.01 Statistical Package for Social Sciences to conduct statistical analysis. For tables including frequencies, we used the chi-square test; for data containing means and standard deviations, we used the independent sample t-test. A p-value of less than 0.05 was set as the significance threshold. Using Pearson correlation, the correlation coefficient is utilized to determine the correlation between the markers under study. The mean and standard error were used to create descriptive statistics for the clinical and laboratory results.

Results and Discussion

Prevalence of Toxoplasma gondii

A total of 150 blood sample collected from CVD patients was included in the study showed that 45(30%) were IgG positive. While 12(8%) % were IgM positive, more than 30 IU/ml considered positive, the overall anti-*T. gondii* IgG and IgM seropositivity was found to be 5(3.3%) in patients who had CVD, as shown in table (1).

Table 1. Seropositivity rates for *Toxoplasma gondii* antibodies among CVD patients.

Parameters	**IgG**		**IgM**		**IgG & IgM**
Results	Positive	Negative	Positive	Negative	Positive
150 patients	45(30%)	105(70%)	12(8%)	138(92%)	5(3.3%)

Anti-*T. gondii* IgG seroprevalence was reported to be 45% in individuals with heart disease in this investigation. The current study is in line with the findings of Khademvatan et al.'s study [13], which found 63.73% seroprevalence of anti-*T. gondii* IgG antibodies in patients with heart disease. Sadaghian et al.'s study [14] found 45.12% seroprevalence of anti-*T. gondii* IgG antibodies in patients with heart disease, which is in line with the current study. These findings suggest that those with heart conditions are at an increased risk of contracting T. gondii infection. Patients with a *T. gondii* infection may be more susceptible to cardiac disease because of the possibility of heart muscle cysts. There has been recent description of *T. gondii's* interaction with skeletal muscle cells [15]. According to Darweesh

[16], 38% of the cases had positive IgG-ELISA results. Ali et al. [17] found that among toxoplasmosis patients in Dhi Qar Province, Iraq, the rate of seroprevalence for IgG antibodies was 36.45%. IgG antibodies against T. gondii were reported to be 34.8% prevalent in Erbil, Iraq, according to Abdullah and Mahmood [18]. These findings were consistent with a study conducted in the Iraqi region of Duhok by Mohammed et al. [19], which found that 35.61% of patients had an IgG seropositive. These results were similar to those of Mousavi-Hasanzadeh et al. [20], who found that IgGnti-Toxoplasma antibodies were present in 33.5% of patients.

Lipid profile

Table (2) showed some serological parameters in groups of study. Total cholesterol, triglyceride LDL and VLDL showed significant (P≤0.05) elevations in patients and in those with both CVD and Toxoplasma compared with control group. HDL showed a significant (P≤0.05) decrease in patients and in those with both CVD and Toxoplasma compared with control group.

Table 2. Lipid profile parameters across study groups.

Groups / Parameters	CVD	CVD and Toxoplasma	Control
Total cholesterol (mg/dl)	278.05±26.32 a	281.17±34.93 a	129.7±18.5 b
Triglyceride (mg/dl)	231.54±13.28 a	243.41±29.01 a	93.11±12.42 b
HDL (mg/dl)	29.65±5.22 b	30.81±4.11 b	49.59±8.15 a
LDL (mg/dl)	199.83±28.01 b	201.92±21.63 b	61.74±12.43 a
VLDL (mg/dl)	45.31±6.39 b	48.35±5.52 b	18.54±3.82 a

**Same letters mean non-significant (P≤0.05) differences.*

For many years, researchers have examined the correlation between the incidence of cardiovascular disease (CVD) and the death from CVD, as well as the levels of blood cholesterol (TC, LDL-C, and HDL-C). Nevertheless, no meta-analysis has been conducted on the relationship between serum cholesterol levels and CVD mortality. Cholesterol is commonly considered a causative factor for CVD and is a focus of CVD treatment [21]. One known and proven risk factor for cardiovascular disease is elevated TC. A significant meta-analysis of observational data revealed a correlation between elevated serum troponin C levels and a higher mortality risk from coronary heart disease [22]. The Framingham Heart Study provided the first convincing analysis of the inverse relationship between HDL-C and CHD [23]. The HDL-C hypothesis which holds that increasing HDL-C by intervention would lower the risk of coronary heart disease was generated by this observational study, which also provided the foundation for the generally accepted notion that HDL-C is good cholesterol and may have protective effects against atherosclerosis. Following the Framingham reports, numerous animal research and observation studies provided evidence in favor of this theory. On the other hand, some research revealed that extremely high HDL-C levels are no longer completely protective, meaning that peripheral cholesterol is being removed. Furthermore, several significant HDL activities, including anti-inflammatory, antiapoptotic, antioxidant, and vasorelaxant effects, that are linked to the risk of CVD are not represented by the cholesterol level of HDL [24-25]. The correlation between blood cholesterol levels and human parasite infection has caught the interest of several professionals. Because it is unable to generate cholesterol from scratch, toxoplasma must obtain cholesterol derived from LDL from the host cell through endocytosis, which is carried out by the LDL receptor or a protein linked to the LDL receptor. There is a theory that host cholesterol, not parasite cholesterol, regulates Toxoplasma's ability to enter cells [26]. These investigations demonstrated that cholesterol plays a significant part in toxoplasmosis etiology. Nevertheless, little is known about the origins of parasite lipids, and it is unclear how Toxoplasma obtains host cell lipids through molecular pathways [26]. Previous research has demonstrated that individuals with parasite infections had increased levels of lipoproteins such as total cholesterol, LDL, and HDL [27].

Conclusion

The findings of this study indicate a significant association between *Toxoplasma gondii* infection, dyslipidemia, and cardiovascular disease among patients in Kirkuk Governorate. The marked alterations in lipid profile parameters including increased total cholesterol, triglycerides, LDL, and VLDL, together with decreased HDL suggest that *T. gondii* infection may aggravate lipid metabolism disturbances in individuals with existing cardiovascular conditions. The observed seroprevalence of anti-*T. gondii* antibodies further supports the possibility that chronic or reactivated infection contributes to metabolic imbalance and may act as an additional risk factor for cardiovascular complications. These results highlight the importance of screening for toxoplasmosis in CVD patients and indicate that addressing parasitic infection may help reduce dyslipidemia-related cardiac risks. Further studies using larger cohorts and advanced diagnostic techniques are recommended to better clarify the biological mechanisms linking *T. gondii* infection to cardiovascular dysfunction.

Conflict of Interest

The authors declare no conflict of interest regarding the publication of this manuscript.

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