

## Investigating the Prevalence and Diagnostic Markers of Toxoplasma Infection in Patients with Acute Coronary Syndrome

Ala'a Dakhel Abdul Hassan 1 & Habeeb Waseel Shubber 2

Department of Biology, College of Science, University of Al-Qadisiyah, Al-Diwaniyah, Iraq.

### ABSTRACT

Toxoplasma infection is a prevalent parasitic disease with various clinical manifestations and potential links to cardiovascular health. This research aimed to investigate the prevalence and diagnostic markers of Toxoplasma infection in patients with acute coronary syndrome (ACS). Serum IgG levels and blood group distribution were analyzed as potential indicators of Toxoplasma infection. The study included 120 ACS patients and 180 individuals in a healthy control group. Serum IgG levels were measured, and blood group types were determined. Statistical analysis, including chi-square tests, was conducted to assess the significance of the findings.

The results revealed a significant association between Toxoplasma infection and ACS. Among the ACS patients, 35.0% tested positive for serum IgG, indicating the presence of Toxoplasma infection. In contrast, only 10.0% of the healthy control group showed positive IgG results. This stark difference in IgG positivity between the two groups was highly significant ( $P < 0.001$ ), highlighting the increased prevalence of Toxoplasma infection in ACS patients. Furthermore, the distribution of blood group types in relation to Toxoplasma infection was investigated. The analysis showed no significant differences in blood group distribution between patients with and without toxoplasmosis and healthy individuals with and without toxoplasmosis.

These findings suggest that serum IgG testing can serve as a valuable diagnostic tool for identifying Toxoplasma infection in ACS patients. Understanding the association between Toxoplasma infection and cardiovascular diseases like ACS can have implications for preventive measures and targeted treatment strategies. Further research is needed to explore additional diagnostic markers and risk factors associated with Toxoplasma infection, facilitating a better understanding of its impact on cardiovascular health and potential therapeutic interventions.

**Keywords:** Toxoplasma infection, acute coronary syndrome, serum IgG, blood group distribution, prevalence, diagnostic markers.

### INTRODUCTION

Toxoplasma infection, caused by the parasite *Toxoplasma gondii*, is a globally prevalent parasitic disease that affects millions of people worldwide. While traditionally associated with mild flu-like symptoms, Toxoplasma infection can have severe consequences, particularly in immunocompromised individuals and pregnant women. Emerging evidence suggests that this parasitic infection may also be associated with various cardiovascular diseases. Understanding the potential links between Toxoplasma infection and cardiovascular health is crucial for the development of effective diagnostic strategies and targeted interventions 1.

Several studies have indicated a possible connection between Toxoplasma infection and acute coronary syndrome (ACS), a group of conditions characterized by reduced blood flow to the heart. These studies have reported higher seroprevalence rates of Toxoplasma antibodies in patients with ACS compared to healthy individuals. However, further investigation is required to establish a definitive association and elucidate the underlying mechanisms 2.

Additionally, blood group distribution has been implicated as a potential factor in susceptibility to Toxoplasma infection. Certain blood group types have been proposed to confer either increased or

decreased susceptibility to infection. Exploring the distribution of blood groups in individuals with Toxoplasma infection and assessing its relevance to disease severity and outcomes may provide valuable insights into the pathogenesis and clinical implications of this parasitic infection 3.

In recent years, there has been growing interest in exploring the potential links between Toxoplasma infection and cardiovascular health. Several studies have reported associations between chronic Toxoplasma infection and an increased risk of cardiovascular diseases such as acute coronary syndrome (ACS), myocardial infarction, and stroke. These associations may be attributed to the chronic inflammatory response elicited by the parasite, which can promote atherosclerosis, endothelial dysfunction, and thrombosis 4.

One of the key diagnostic markers used in the assessment of Toxoplasma infection is the measurement of specific antibodies, such as immunoglobulin G (IgG). Detection of Toxoplasma-specific IgG antibodies in the serum can indicate a previous or ongoing infection. However, the prevalence of Toxoplasma infection and its association with serum IgG levels in patients with ACS have not been extensively studied 5-7.

This research aims to investigate the prevalence of Toxoplasma infection in patients with ACS and examine the potential associations between Toxoplasma infection, serum IgG levels, and blood group distribution. By elucidating the role of Toxoplasma infection in the context of cardiovascular health, this study aims to contribute to the existing knowledge and pave the way for improved diagnostic and therapeutic approaches.

## **Method and Material**

### **Study Design:**

This research employed a cross-sectional study design to investigate the prevalence of Toxoplasma infection in patients with acute coronary syndrome (ACS) and explore the association between Toxoplasma infection, serum IgG levels, and blood group distribution. The study aimed to collect data from both patient and control groups and analyze them to draw conclusions about the relationship between Toxoplasma infection and cardiovascular health.

### **Participants:**

The study included two groups: ACS patients and a healthy control group. The ACS patient group consisted of individuals diagnosed with acute coronary syndrome, while the control group comprised individuals without any known cardiovascular diseases or symptoms. The sample size consisted of 120 ACS patients and 180 individuals in the control group.

### **Samples Collection:**

Serum IgG levels were measured in both the ACS patient group and the control group using validated laboratory tests. Blood samples were collected from participants, and IgG levels were assessed to determine the presence or absence of Toxoplasma infection. Additionally, blood group types were determined for all participants using standard methods.

### **Blood Group Determination:**

Blood group types were determined for all study participants using standard methods. Blood samples were analyzed to identify the ABO blood group system, including A, B, AB, and O blood types. The distribution of blood groups in relation to Toxoplasma infection was assessed to explore potential associations.

### **Statistical Analysis:**

The collected data were subjected to statistical analysis to assess the significance of the findings. Descriptive statistics were used to summarize the characteristics of the study population, including demographic information and distribution of serum IgG levels and blood group types. To evaluate the association between Toxoplasma infection and ACS, the chi-square test was employed. The test examined the differences in IgG positivity rates and blood group distributions between the ACS patient group and the control group. The significance level was set at  $P \leq 0.05$  to determine statistical significance.

## Results

Table 1 presents the results of serum IgG testing in both the ACS patient group and the healthy control group. The table shows the total number of participants in each group, the number and percentage of participants with positive IgG results (indicating Toxoplasma infection), the number and percentage of participants with negative IgG results (indicating no Toxoplasma infection), and the associated p-value.

In the ACS patient group, out of the total 120 patients, 42 (35.0%) tested positive for Toxoplasma-specific IgG antibodies, indicating the presence of Toxoplasma infection. On the other hand, 78 (65.0%) patients in the ACS group tested negative for Toxoplasma-specific IgG, suggesting no evidence of current or past Toxoplasma infection.

In the healthy control group, consisting of 60 individuals, 6 (10.0%) participants tested positive for Toxoplasma-specific IgG, while the majority, 54 (90.0%), tested negative for Toxoplasma infection.

The p-value provided in the table is the result of the chi-square test, which was conducted to assess the statistical significance of the difference in IgG positivity rates between the ACS patient group and the healthy control group. The p-value in this case is  $<0.001$ †, indicating that the difference in IgG positivity rates between the two groups is highly significant.

Table 1: Serum IgG Results in Patients and Healthy Control Group.

Study Groups	Total Number	Positive IgG (n, %)	Negative IgG (n, %)	P Value
ACS Patients	120	42 (35.0%)	78 (65.0%)	$<0.001$ †
Healthy Controls	60	6 (10.0%)	54 (90.0%)	
Total	180	48	132	

†: Chi-square test; HS: highly significant at  $P > 0.001$

Table 2 presents the frequency distribution of patients and control subjects according to blood groups, categorized based on the presence or absence of Toxoplasma infection. The table provides information on the blood group distribution in patients with Toxoplasma infection, patients without Toxoplasma infection, healthy individuals with Toxoplasma infection, and healthy individuals without Toxoplasma infection.

The table displays different blood groups (A+, B+, AB+, A-, AB-) and the corresponding number and percentage of participants in each group. It also includes a p-value, which represents the statistical significance of the differences in blood group distributions between different categories.

For example, in the group of patients with Toxoplasma infection (N=42), the most common blood group observed is A+ (22 participants or 52.4%), followed by B+ (12 participants or 28.6%), AB+ (6 participants or 14.3%), A- (1 participant or 2.4%), and AB- (1 participant or 2.4%).

In the group of patients without Toxoplasma infection (N=78), the blood group distribution is slightly different. The most common blood group is A+ (38 participants or 48.7%), followed by B+ (23 participants or 29.5%), AB+ (10 participants or 12.8%), A- (3 participants or 3.8%), and AB- (4 participants or 5.1%).

Similarly, the blood group distribution is shown for healthy individuals with and without Toxoplasma infection. In the group of healthy individuals with Toxoplasma infection (N=6), the blood group A+ is again the most common (3 participants or 50.0%), followed by B+ (1 participant or 16.7%) and AB+ (2 participants or 33.3%). In the group of healthy individuals without Toxoplasma infection (N=54), the blood group distribution is similar to the patients without Toxoplasma infection.

The p-value indicates the statistical significance of the observed differences in blood group distributions. In this case, the p-value is 0.971¥, suggesting that the differences in blood group distributions between the different categories (patients with and without Toxoplasma infection, healthy individuals with and without Toxoplasma infection) are not statistically significant (NS).

Table 2: Frequency Distribution of Patients and Control Subjects According to Blood Groups.

Blood Group	Patients with Toxoplasmosis (N=42)	Patients without Toxoplasmosis (N=78)	Healthy with Toxoplasmosis (N=6)	Healthy without Toxoplasmosis (N=54)	P Value
A+	22 (52.4%)	38 (48.7%)	3 (50.0%)	25 (46.3%)	0.971¥
B+	12 (28.6%)	23 (29.5%)	1 (16.7%)	18 (33.3%)	
AB+	6 (14.3%)	10 (12.8%)	2 (33.3%)	9 (16.7%)	
A-	1 (2.4%)	3 (3.8%)	0	1 (1.9%)	
AB-	1 (2.4%)	4 (5.1%)	0	1 (1.9%)	

n: number of cases; ¥: Chi-square test; NS: not significant at  $P \leq 0.05$

Table 1 presents the results of serum IgG testing, indicating the presence or absence of Toxoplasma infection, in both the ACS patient group and the healthy control group. The findings show a significantly higher percentage of positive IgG results in the ACS patient group compared to the healthy control group (35.0% vs. 10.0%,  $p < 0.001$ †). These results suggest that Toxoplasma infection may be more prevalent among patients with acute coronary syndrome.

The higher prevalence of Toxoplasma infection in ACS patients aligns with previous studies that have suggested a potential association between chronic infections, including Toxoplasma infection, and the development or progression of cardiovascular diseases (Bartova et al., 2020; Xue et al., 2019). Toxoplasma gondii, the causative agent of Toxoplasma infection, has been shown to trigger chronic

inflammation and immune responses, which may contribute to the pathogenesis of cardiovascular diseases (Koshy et al., 2010).

Table 2 provides the blood group distribution among participants categorized based on *Toxoplasma* infection status. The results indicate that the distribution of blood groups does not significantly differ between patients with and without *Toxoplasma* infection, as well as between healthy individuals with and without *Toxoplasma* infection ( $p=0.971\text{¥}$ ). These findings suggest that blood group type may not be a significant factor influencing susceptibility to *Toxoplasma* infection in this study population. The lack of significant differences in blood group distribution aligns with some previous studies that found no association between ABO blood groups and *Toxoplasma* infection (Jalal et al., 2016; Fallahi et al., 2016). However, it is important to note that these results may vary across different populations and geographic regions. Further research involving larger sample sizes and diverse populations is needed to fully explore the potential relationship between blood groups and *Toxoplasma* infection.

In conclusion, the findings of this study provide valuable insights into the relationship between *Toxoplasma* infection and acute coronary syndrome (ACS), as well as the potential influence of blood groups on *Toxoplasma* infection. The results from Table 1 indicate a significantly higher prevalence of *Toxoplasma* infection among ACS patients compared to the healthy control group. This suggests a potential association between *Toxoplasma* infection and the development or progression of ACS. These findings are consistent with previous studies linking chronic infections, including *Toxoplasma* infection, to cardiovascular diseases. The blood group type may not be a significant factor influencing susceptibility to *Toxoplasma* infection in the study population. The distribution of blood groups did not show any significant differences between patients with and without *Toxoplasma* infection, as well as between healthy individuals with and without *Toxoplasma* infection. These results are in line with some previous studies, although the relationship between blood groups and *Toxoplasma* infection may vary across different populations.

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