The Role of C-Reactive Protein in the Infections Caused by Parasites (Review)

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Abstract

Background: Inflammation causes a rise in the levels of certain proteins; these proteins are identified as acute stage proteins and one of these proteins is C-reactive protein (CRP). CRP composed of 206-amino acid of the short pentraxin family.

Objective: This review assessed CRP as an inflammatory indicator that has an important role in the host’s defense against infection and also it is documented the pivotal role of this protein during infections with different parasites.

Conclusion: This review is hypothesizing that CRP levels rise during infections caused by parasites. Other studies revealed that there is no association of soil-transmitted helminths infections with the increasing levels of CRP.

Keywords: C-reactive protein; protozoan parasites; soil-transmitted helminths

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Introduction

One of the acute-phase inflammatory proteins is C-reactive protein (CRP). Its levels raised during inflammatory conditions for instance rheumatoid arthritis and infections. In addition, CRP is a vital regulator of inflammatory courses [1]. Tillet and Francis, 1930 firstly discovered CRP during their investigation of the sera in patients who had an acute stage of Pneumococcus infection [2]. CRP composes of five identical 23-kDa protomers organized regularly around a central pore. Pentraxins is a term that has been used to describe the family of associated proteins with this structure [3, 4]. CRP is produced in many cells such as lymphocytes, hepatocytes, adipocytes, smooth muscle cells, liver, macrophages and endothelial cells [1]. CRP concentration in the plasma deviates about 25% during inflammatory syndromes [5]. With some bacterial infections, the CRP concentration raised up to 1,000-fold [6]. Though, when the motivation eliminated, CRP levels drop within 18–20 hrs [7]. In harmful tissue disorders for example trauma and cancer, CRP plasma concentration rises from about 1 µg/mL to around 500 µg/mL within 72 hrs [8]. Interleukin 6 is a major stimulator of CRP gene expression but it is not sufficient to achieve this alone, while IL-1 stimulates its effect [9,10]. Human CRP motivates complement 9 and 10 and
stimulates tissue-factor production [11, 12]; this proposes that CRP may have pro-inflammatory effects that contribute to pathogenesis atheroma [13].

CRP has a role in recognizing the foreign pathogens and infected cells through binding with the phosphocholine arm when it exists. It can stimulate the complement system and phagocytic cells via Fc receptors to remove the cellular debris or apoptotic cells and foreign pathogens. It can also lead to tissue damage in certain cases due to activation of the complement system [14, 15, 16]. CRP has a vital role in protection against infection, removing the injured tissue, and regulation of the inflammatory response. It has both pro- and anti-inflammatory effects. CRP acts as an opsonin that binds with the polysaccharide residues on bacteria, fungi, and parasites to stimulate the complement and phagocytosis [17].

C-Reactive Protein and Leishmaniasis

The protozoan Leishmania causes Leishmaniasis disease. The cells of the reticuloendothelial system infect by this parasite [18]. The host immune response against leishmaniasis includes cytokines, antibodies, and acute-phase proteins mainly CRP in normal serum [19]. After tissue damages and infections, CRP significantly increases as a non-specific innate immunity of the host. It is an indicator of inflammatory responses and cytokine motivation [20]. The extensive spreading of phosphocholine in pathogens polysaccharides and in cellular membranes allows CRP to distinguish a variety of pathogens in addition to the damaged membranes and necrotic cells [21]. Musa (2015) revealed that a significant rise in the CRP level (4.36± 0.23 mg/l) compared with the control group (2.50 ± 0.28mg/l) in patients with visceral leishmaniasis [22]. Another study confirmed that the mean value of CRP before treatment was significantly greater than the control group [23].

C-Reactive Protein and Malaria

Malaria is a common infection in tropical and subtropical areas [24]. This disease causes high morbidity and mortality in Africa [25]. In malaria, some blood tests, liver function tests, and other indicators have been used. CRP has considered a significant biomarker in malaria especially in the endemic areas where predictable disease signs such as fever might lacking even in people with high parasitic infection [26]. CRP concentration strongly relates with the parasite density in patients’ blood [26, 27]. CRP levels is accompanying with malaria [28,29] and other infections [30,31]. It is essentially stimulates the complement pathway, platelet [32], binding to infected erythrocytes and lead to their omitting [33].

In spite of the stated efficacy of traditional CRP examinations in malaria, an additional subtle method is needed for the early observation of malaria complications. Providing a sensitive test for CRP allows detecting low-scale changes in CRP concentration (1-10 mg/L) in contrasting to the traditional test (10-1000 mg/L). A study revealed that high-sensitivity CRP levels increase when the parasite density increase in children infected with malaria [34]. Other studies showed that the High-sensitivity CRP levels increased significantly to high parasitemia, this finding proposes that the high-sensitivity CRP values could be a
C-Reactive Protein, Entameobiasis and Giardiasis

Diarrheal diseases are widespread in developed and developing countries [37]. Diarrhea is caused by viruses, bacteria, and parasites [38]. Giardia lamblia and Entamoeba histolytica are the main intestinal parasitic causes for diarrhea [39]. These pathogens cause an important public health [40]. Amoebic dysentery and an amoebic liver abscess are caused by E. histolytica, leading to over a hundred thousand deaths annually [41], while 5-10% of the population is in danger of giardiasis [42]. Giardiasis and entameobiasis and are often spread by contaminated food and drinking water, or through fecal-oral contact [43].

A study proved that CRP level increased in the chronic presentation of diarrhea caused by G. lamblia and E. histolytica, thus CRP can be used as a nonspecific immunological marker for checking the clinical presentation of G. lamblia and E. histolytica infection [44]. This activity is more controlled by time and the levels of CRP will be raised after the acute phase of diarrhea caused by G. lamblia and E. histolytica [45,46]. The immune response progress plays a role in the negative relationship between the acute phase of diarrhea caused via G. lamblia and E. histolytica and the CRP level; the innate immunity distinguish molecules on the G. lamblia and E. histolytica membrane that cause stimulating mucosal related macrophages and CRP level will slightly raise [47]. The site of G. lamblia and E. histolytica infection in the gut mucosa consider as an additional probable reason for the declining CRP concentration during acute phase of diarrhea; this will protect the parasite from mucosal IgA and IgM as a humoral immune response and from phagocytic by macrophages. Another reason for the low levels of CRP during acute phase of diarrhoea related to giardiasis and entameobiasis is the small number of parasites that swallowed [48,45]. Long periods of infection stimulates the activity of hepatocytes to synthesize CRP. On the other hand, attachment of the parasite on the mucosal surface leads to tissue destruction which in turn stimulates the hepatocytes to increase CRP production as the innate response that cooperated with the stimulating phagocytic macrophages and mucosal IgA response against entameobiasis and giardiasis. Therefore, there is a positive significant increase in the CRP level through the chronic phase of G. lamblia and E. histolytica related diarrhea [49,50].

C-Reactive Protein and Toxoplasmosis

Toxoplasmosis is caused by Toxoplasma gondii, an opportunistic protozoan parasite, and produces asymptomatic infection and then remains dormant in the host, however it could reactivate later in life [51]. Oocysts in contaminated food or water or tissue cysts in undercooked meat are the most causes of infection [52, 51].

Studies demonstrated that T. gondii infection is related to the raising level of CRP [53,54], which detected in a mouse infected with chronic infection of T. gondii [55]. Soliman, 2012 establish that 27 samples had positive CRP, this suggests a possible interaction of T. gondii with the immune
response [56]. CRP is an inflammatory indicator that plays an important role in infection [57]. When comparing CRP with LAT and ELIZA results, 17 samples were found positive in Latex and CRP tests, while 19 samples were found positive in both ELIZA and CRP tests, this demonstrating that T. gondii may be associated to the systemic inflammation [58].

C-Reactive Protein and Soil-Transmitted Helminths

Around a quarter of the world's population is at danger of infection with the soil-transmitted helminths (STH) including Strongyloides stercoralis, Trichuris trichiura Ancylostoma duodenale, Necator americanus, and Ascaris lumbricoides [59]. Many of inflammatory markers were revealed within two study populations (Cuban and Cambodian schoolchildren) with different STH species prevalence and general nutritional status. De Gier et al., 2018 showed that there was no significant relation of STH infections with acute phase proteins. They also detected lower CRP levels in children infected with STH compared with uninfected children [60].

Conclusions

This review documented that the CRP level increased in correlation with the protozoan parasitic infection and such correlation do not present with soil-transmitted helminths infection.

Recommendations

Detection the level of CRP can be considered as a nonspecific indicator for checking the clinical manifestation of the protozoan parasitic infection due to the possible correlation between them.

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The Role of C-Reactive Protein in the Infections Caused by Parasites (Review)

Entsar Jabbar Saheb

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The Role of C-Reactive Protein in the Infections Caused by Parasites (Review)

Entsar Jabbar Saheb

1. Introduction

C-Reactive protein (CRP) is an acute phase protein (APP) that is a marker of inflammation. CRP levels rise in response to infection and inflammation and can be used to monitor disease activity and response to treatment. It has been used as a diagnostic tool and a prognostic marker in various infections caused by parasites.

2. CRP in Parasitic Infections

CRP has been shown to be a useful marker for infections caused by parasites such as Giardia lamblia and Entamoeba histolytica. In a study by Al-Ezzy AI, Abood WN, Hussein, RA., C- reactive protein was found to be a prognostic marker for Giardia lamblia and Entamoeba histolytica associated diarrhea among children of Baghdad Governorate. IJASR. 2015; 1(01): 33-7.

3. Global Burden of Parasitic Diseases

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4. Parasites and CRP

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5. Pathological Strategies

CRP has been used as a pathological marker in infections caused by parasites. A study by Al-Ezzy AI, Abood WN, Hussein, RA. C- reactive protein as an immunopathological prognostic marker for Giardia lamblia and Entamoeba histolytica associated diarrhea among children of Baghdad Governorate. IJASR. 2015; 1(01): 33-7.

6. Conclusion

CRP is a useful marker for infections caused by parasites. It can be used as a diagnostic tool and a prognostic marker. Further research is needed to fully understand the role of CRP in infections caused by parasites.

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The Role of C-Reactive Protein in the Infections Caused by Parasites (Review)

Entsar Jabbar Saheb

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