

Correlation of CT Findings with C-Reactive Protein in COVID-19 Positive PCR Patient in Kerbala Governorate / Iraq

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Abstract

Objective: this study aimed to assess the presence of a relationship between C-reactive protein and CT-finding in PCR positive COVID-19 patients.

Materials/methods: From August 1 to October 1 of 2020, a total of 198 patients were suspected of COVID 19 based on clinical indications. CT scan was performed, and PCR tests were preformed and we were able to collect their serum to measure the C-reactive protein in their blood by ELISA. They were eventually diagnosed with COVID19. The statistical analysis was performed using the SPSS 24.0 software.

Results: the prevalence of the males in the selected sample of diagnosed COVID 19 was higher than females where the males were (108, 54%), while the females had a lesser frequency of infection (92, 46%). A significant correlation between the level of CRP in PCR positive COVID 19 patients (P -value =0.05). A significant correlation was found between the level of C-reactive protein and CT scan findings (Ground Glass Opacity) P -value <0.01.

Conclusions: the levels of C-reactive protein were elevated in blood of COVID19 patients.

Key words: COVID 19, Coronavirus, Ground Glass Opacity, GGO, Consolidation, C-reactive protein, CRP.

Introduction

Covid19 is worldwide spread infection and a major health risk especially to critically ill patients (1). Since the first report of the coronavirus in Wuhan providence in China, the virus

Spread rapidly around the world. The World Health Organization has raised the assessment of the risk of spread and the risk of impact to very high at a global level on February 2020 (2). The diagnostic stage of the COVID19 is still in the exploratory level. The monitoring and treatment strategies are important to improve the fatality rate (3). CT scan played an important role in assessing the disease (4). Other laboratory finding such as C-reactive protein may predict severity of COVID1 (5). C- reactive protein (CRP) is obsolete protein act in human as pro-inflammatory or anti-inflammatory according to condition (6). The level of CRP usually is low in viral infection than bacterial infection that causes respiratory tract infection (7). It can be used as a prediction marker for respiratory tract infection caused by viruses (8, 9).

Materials and methods:

From August 1 to October 1 of 2020, patients who complained of cough, chest pain and other respiratory or digestive symptoms with or without fever, attending the Al-Imam Hussein Medical City were screened by qRT-PCR for SARS-CoV-2, and all the patients of positive results were included in this study. Upon admission, patients underwent blood routine test, chemical and immunological routine test, plasma CRP quantification, chest CT scanning to assess the severity of COVID-19.

The CT scan evaluation with image analysis and grading were performed by three experienced radiologists. The final scores and grading were determined by consensus. CT scores were recorded following previous research with some modifications (10). In particular, 4 categories were assigned according to visual assessment of the involvement of each of the five lung lobes independently: 1-25% involvement; 26%-50% involvement; 51% to 75% involvement; 76-100% involvement. The total CT score was the sum of the scores of the individual lobes.

A total of 198 patients were suspected of COVID 19 based on clinical indications were selected for this study. CT scans were performed, and PCR tests were performed and we were able to collect their serum to measure the C-reactive protein in their blood by ELISA. Blood samples were analyzed by standard method in the central laboratory. They were eventually diagnosed with COVID19. The statistical analysis was performed using the SPSS 24.0 software.

Results

In the current study the most of the infected sample of patients was the males (108, 54%), while the females had a lesser frequency of infection (92, 46%).

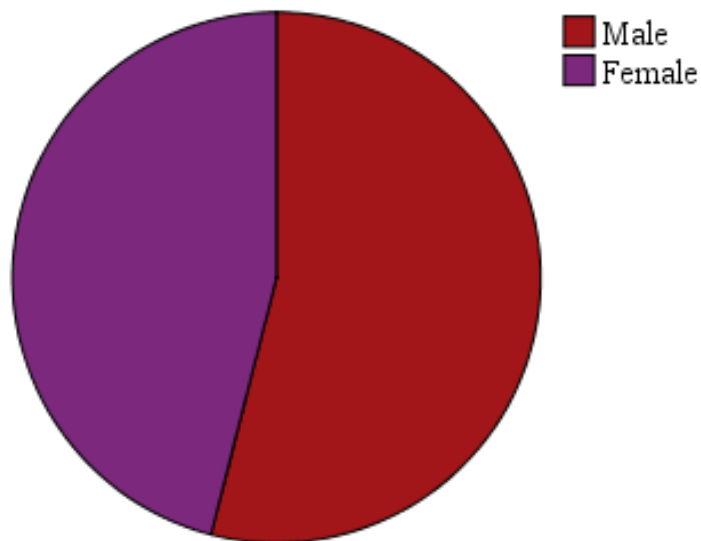


Figure 1: the female / male ratio in COVID19 sample.

Table 1 shows the correlation of PCR and CRP in this selected sample. Here we found a significant correlation between the level of CRP in PCR positive COVID 19 patients. Only 14 of the PCR positive COVID19 patient sample were found to have a normal rang for CRP. While 2 patients had a negative PCR results for COVID 19, they had an elevated level of CRP in their blood.



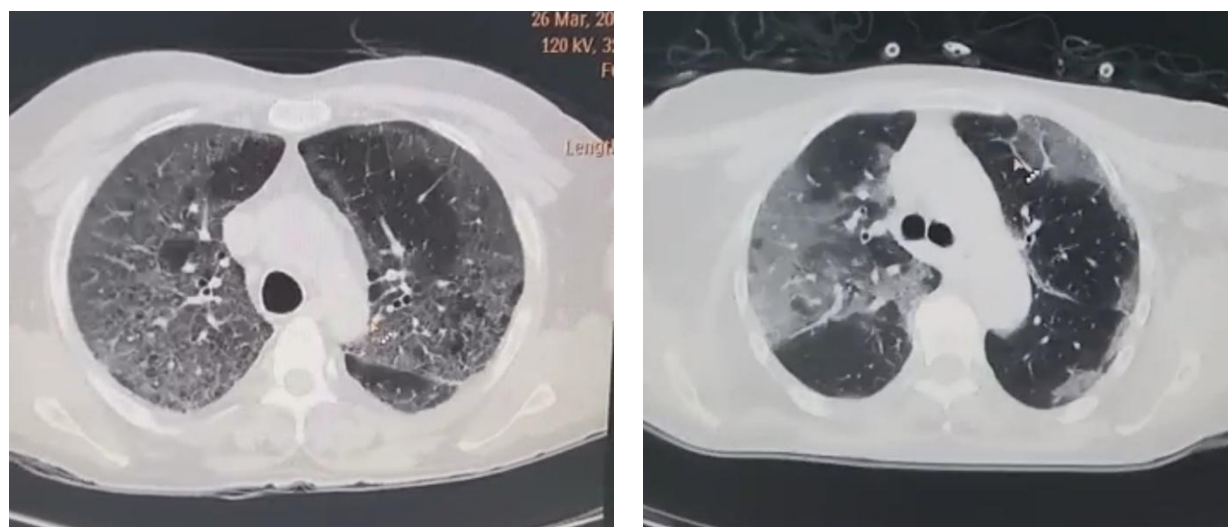


Figure 2: CT examples of the GGO in patients diagnosed with COVID19.

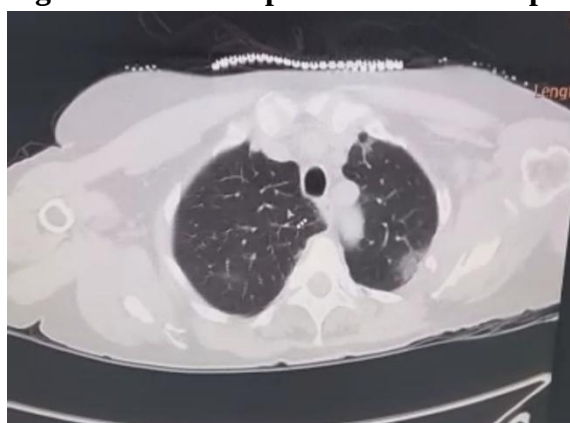


Table 1: The range of CRP and PCR results in patients with COVID 19.

CRP	PCR	
	Negative	Positive
0-6**	0	14
7-20	0	26
21-40	0	68
41-60	0	12
61-80	0	16
>101	2	62
Total	2	198

* P-value =0.05

** normal range of C-reactive protein

In this study we categorized the levels of CRP from (0-6) which was the normal range and graded to higher ranges (7-20, 21-40, ..., >101). These categories aimed to further clarify the correlation between the level of CRP with Ground Glass Opacity (Table 2). The estimated

Ground Glass Opacity was also categorized into 4 groups reading the percentage of damage inflicted on the lung tissues. In patients whom had normal ranges of CRP 12 patients had low (1-25%) OGG in their lung tissue while patients with elevated CRP level 52 patients had that same percentile of OGG and 4 patient had a high (51-75) GGO. A significant correlation was found between the level of C-reactive protein and CT scan findings (Ground Glass Opacity) P -value <0.01 .

Table 2 shows the correlation between ground glass opacity and C-reactive protein.

CRP	GGO%			
	0-25	26-50	51-75	76-100
0-6*	12	2	0	0
7-20	24	2	0	0
21-40	52	12	4	0
41-60	4	8	0	0
61-80	4	12	0	0
>101	16	36	2	10
Total	112	72	6	10

***normal range of C-reactive protein.**

**** P -value <0.01 .**

The correlation between CRP and GGO in COVID 19 diagnosed patients was investigated, table 3 shows a significant correlation between these variables, P -value=0.016.

Table 3: correlation between level of C-reactive protein and Ground Glass Opacity in COVID 19 positive patients.

GGO	PCR	CRP						Total
		0-6*	7-20	21-40	41-60	61-80	>101	
0-25	Positive	12	24	52	4	4	16	112
26-50	Positive	2	2	12	8	12	36	72
51-75**	Negative			0			2	2
	Positive			4			0	4
76-100	Positive						10	10
Total	Negative	0	0	0	0	0	2	2
	Positive	14	26	68	12	16	62	198

***normal range for C-reactive protein.**

**** P -value = 0.016**

Discussion

At present, the global outbreak of the SARS-COV-2 epidemic has brought serious burdens to the medical system. The number of patients with COVID-19 is rapidly increasing globally, and asymptomatic patients are also the source of infection (11). COVID-19-related case fatality is also rapidly increasing. COVID-19 is a new threat for populations (12-14), and treatment options need to be evaluated (15). Early monitoring of key indicators was an important basis to guide treatment strategies, and early assessment of the severity of patients' condition was of great value (16). The main pathological changes of COVID-19 are lung and immune system damage (3).

CT dynamic monitoring may be used to identify the characteristic imaging of lung changes: multiple small patch shadows and stromal changes are observed in the early stage and the lung exudate is obvious (17), which then develops into multiple ground-glass shadows and infiltrating shadows in both lungs (18). CT scan examination, as a quick and simple method to screen for pulmonary infection, cannot only determine the presence of pulmonary infection but it can also provide a reference for determining the type of pathogen, with unique diagnostic advantages. According to Zhong Nanshan's latest research, the sensitivity of COVID-19 diagnosis with CT scan alone was 76.4%, and the application of CT scan in COVID-19 was evaluated as useful (19). A 50% increase in lung X-ray findings within 24 to 48 hours was considered an early warning indicator of impending conversion to critical disease. The CT scan can sometimes predict the prognosis of patients (20). Studies by Chen Lin et al. all suggested the value of the CT scan in the diagnosis and of COVID-19 (4). CT dynamic monitoring of lung lesions was limited. A simple index evaluation with good correlation with pulmonary pathological changes is required.

CRP levels are correlated with the level of inflammation, and its concentration level is not affected by factors such as age, sex, and physical condition (21). CRP levels can activate the complement and enhance phagocytosis, thus clearing the pathogenic microorganisms invading the body. CRP levels can be used for early diagnosis of pneumonia (22), and patients with severe pneumonia had high CRP levels. It is an important index for the diagnosis and assessment of severe pulmonary infectious diseases (23). Matsumoto's study also showed the value of CRP levels in severe pneumonia (24). This study showed that CRP levels and the diameter of the largest lung lesion increased as the disease progressed. CRP levels were positively correlated with lung lesion and disease severity. This suggests that in the early stage of COVID-19, CRP levels could reflect lung lesions and disease severity.

The study of Han et al show covid-19 patients with GGO have high level of CRP (25). Also, the study of Zhu et al indicated patient with GGO with or without consolidation have high level of CRP ($P < 0.05$) in covid-19 patient (26). These two studies agree with our result as (Table 3) find out there is a significant correlation between elevated c- reactive protein and GGO of CT scan

finding (P-value=0.016.) this correlation explains the progression degree of severity in covid -19 patients

Conclusion

We concluded that the increase of C-reactive protein ranges in plasma of patient suspected of COVID 19 due to clinical manifestations and positive PCR results can be an indicator of disease severity after comparing with the CT scan finding and estimated Ground Glass Opacity levels.

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