



## Research Article

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# Evaluation of diagnostic value of laboratory tests (CRP, WBC and ESR) in patients with COVID-19 in Shahid Sadoughi Hospital, Yazd

**Soheila Azimi Abarghouei<sup>1</sup>, Zohre Akhondimeybodi<sup>2,3</sup>, Jamshid Ayatollahi<sup>3, 4</sup>, Mohammad Sharif Yazdi<sup>2,3</sup>, Seyed Alireza Mousavi<sup>3</sup>, Fatemeh Mojalal Najjar<sup>1</sup>, Sara Jambersang<sup>5</sup>, Samaneh Mazidi Sharafabadi<sup>6</sup>, Mahdie Hamidfar<sup>3</sup>, Seyed Hossein Shahcheraghi<sup>3</sup>**

<sup>1</sup> Assistant Professor of Emergency Medicine, Department of Emergency Medicine, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>2</sup> Assistant Professor of Prevention and Control of Nosocomial Infections, Department of Infection, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>3</sup> Infectious Diseases Research Center, Shahid Sadoughi Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>4</sup> Hematology and Oncology Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>5</sup> Assistant Professor, Department of Statistics and Epidemiology, School of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

<sup>6</sup> Resident of infectious and tropical diseases, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

## Abstract

COVID-19 disease is spreading rapidly around the world and its control requires proper diagnosis of infected people. RT-PCR is the primary method of laboratory diagnosis of COVID-19, but is associated with false-positive cases. Therefore, the aim of this study was to evaluate the diagnostic value of laboratory tests (CRP, WBC and ESR) in the diagnosis of COVID-19. In a cross-sectional and descriptive-analytical study, the file of 200 patients with COVID-19 admitted to Shahid Sadoughi Hospital in Yazd in 2020-2021 was evaluated and the results of laboratory tests (CRP, WBC and ESR) were recorded. Considering RT-PCR and lung CT scan as the gold standard, the sensitivity and specificity of each test were determined. Data were analyzed using SPSS software. The frequency of positive findings of CT scan, RT-PCR and gold standard in the studied patients were 83.5%, 50% and 91%, respectively. The mean WBC of patients was 109 2.17 and the ESR was 43.79 mm / h. CRP test was also positive in 71.3% of patients. The sensitivity and specificity of WBC, ESR and CRP in the detection of COVID-19 were 31.5%, 62.4% and 73.1%, respectively, and their specificity was 63.6%, 22.2% and 42.1%, respectively. The frequency of CRP, WBC and ESR findings was not significantly different from the gold standard findings in the studied patients ( $P > 0.05$ ). CRP test is more sensitive than ESR and WBC in diagnosing COVID-19 and can be used in screening patients.

**Keywords:** COVID-19, CRP, WBC, ESR.

## INTRODUCTION

On December 31, 2019, China reported cases of idiopathic pneumonia [1]. Using RT-PCR, the researchers named the cause of the disease coronavirus acute respiratory syndrome 2 (SARS-CoV-2) and later coronavirus 2019 (COVID-19) [2]. The emerging coronavirus has crossed international borders, infecting millions individuals around the world, and many have died [3]. Covid-19 is transmitted by inhalation or contact with contaminated respiratory droplets and has an average incubation period of 3-9 days, with an estimated 44% of cases occurring before symptoms occur [4]. According to research, 81% of cases of Covid-19 are mild, but 19% of patients (usually the elderly and people with comorbidities) show acute symptoms of the disease, which may include pneumonia, acute respiratory syndrome and dysfunction of multiple body members [5]. The most important issue in controlling this disease is the correct diagnosis of the disease to start the treatment process and hospitalizing the patient [6].

Clinics play an important role in responding to the prevalence of Covid-19 by setting up triage protocols and isolating suspected Covid-19 patients so that they do not infect others [7]. RT-PCR is considered as the primary method of laboratory diagnosis of this disease, but various studies have shown that RT-PCR test has false negative results [8]. On the other hand, due to pulmonary involvement, the use of CT scan of the lung in the diagnosis of this disease is considered as a standard method [9]. In addition, laboratory tests, especially inflammatory factors such as CRP, WBC and ESR, have recently been considered in this field [10]. Therefore, this study was designed to evaluate the diagnostic value of laboratory tests (CRP, WBC and ESR) in patients with Covid-19 in Shahid Sadoughi Hospital in Yazd.

\*Corresponding author:

**Dr. Seyed Hossein  
Shahcheraghi**

Infectious Diseases Research  
Center, Shahid Sadoughi  
Hospital, Shahid Sadoughi  
University of Medical Sciences,  
Yazd, Iran

Email:  
shahcheraghi@gmail.com

## MATERIALS AND METHODS

In this cross-sectional study, 200 patients were diagnosed with Covid-19 admitted to Shahid Sadoughi Hospital in Yazd. This study was confirmed by the ethics committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

Patients were included in the study that performed either RT-PCR diagnostic test or CT scan of the lung as the standard of diagnosis of Covid-19.

First, patients' demographic information including age, sex and clinical signs were recorded in the checklist. RT-PCR or lung scan as standard gold was performed for all patients.

Images related to CT scans of patients were also examined.

Also, the extent of involvement and the distribution of pneumonia and lesions were evaluated and recorded by a single audiologist. Laboratory tests of patients including CRP, ESR and WBC were extracted from patients' records. Data was analyzed by SPSS version 17 software. In data analysis,  $p < 0.05$  was considered statistically significant.

## RESULTS

In this research, 200 patients with Covid-19 admitted to Shahid Sadoughi Hospital in Yazd entered the study. The demographic characteristics of patients and the number of patients based on the gold standard are showed in Table 1.

The sensitivity and specificity of the tests (WBC, ESR and CRP) are also listed in Table 2.

According to the gold standard, the frequency of tests was according to Table 3.

**Table 1:** Frequency distribution of patients based on the studied variables

Variable		Number	Percent (%)
Gender	Male	101	50.5
	Female	99	49.5
	Total	200	100
Result of CT scan	Positive	167	83.5
	Negative	8	4
	Total	175	100
Result of RT-PCR	Positive	100	50
	Negative	100	50
	Total	200	100
Gold standard	Positive	182	91
	Negative	18	9
	Total	200	100
CRP	Positive	103	62.8
	A little positive	14	8.5
	Negative	47	28.7
	Total	164	100
Age		59.74 ±19.72	
WBC		2.17 ±1.55	
ESR		43.79±31.02	

**Table 2:** Sensitivity and specificity of tests

Test	Sensitivity (%)	Specificity (%)	False positive (%)	False negative (%)
WBC	31.5	63.6	36.4	68.5
ESR	62.4	22.2	77.8	37.6
CRP	73.1	42.1	57.9	26.9

**Table 3:** Comparison of the frequency of CRP, WBC and ESR according to gold standard in the studied patients

Variable		Gold standard		
		Positive Number (%)	Negative Number (%)	Total Number (%)
CRP	Positive	106 (73.1)	11 (57.9)	117 (71.3)
	Negative	39 (26.9)	8 (42.1)	47 (28.7)
	Total	145 (100)	19 (100)	164 (100)
P value		0.135		
WBC	Leukopenia	20 (11.9)	4 (18.2)	24 (12.6)
	Normal	115 (68.5)	14 (63.6)	47 (67.9)
	Leukocytosis	33 (19.6)	4 (18.2)	164 (19.5)
	Total	168 (100)	22 (100)	190 (100)
P value		0.707		
ESR	Positive	88 (62.4)	14 (77.8)	102 (64.2)
	Negative	53 (37.6)	4 (22.2)	57 (35.8)
	Total	141 (100)	18 (100)	158 (100)
P value		0.154		

## DISCUSSION

In the present study, 83.5% of patients had a positive CT scan and 50% had a positive RT-PCR and 91% according to the gold standard were affected by Covid-19. WBC examination of patients at the time of admission showed that out of 200 patients, 12.6% had leukopenia, 19.5% had leukocytosis and 67.9% had normal WBC.

Studies have reported that in the early stages of Covid-19 disease, when patients do not have exclusive symptoms, WBC may often be normal or in some cases fluctuate (increase/decrease) [11].

In 2020, a study on 140 hospitalized patients diagnosed with Covid-19 (based on CT scan) showed that the leukocyte count was within the normal range in 68.1% of patients and in 12.3% of them increased and decreased in 19.6% [12].

Also, in other studies, leukopenia has been reported between 28.1% to 68.1%, depending on the severity of the disease and the underlying condition [13,14].

In the present study, the frequency of positive ESR was including 64.2% of patients and positive CRP in 71.3% of them.

In the study of Mardani *et al.* (2020) it was observed that the CRP result in Covid-19 positive and negative cases (based on RT-PCR) was 54% and 27.6%, respectively, which was statistically significant [15].

Also in 2021, a study found that patients with a positive test for Covid-19 had higher age, more comorbidities, and higher levels of inflammatory markers such as ESR and CRP than non-Covid-19 patients [16].

## CONCLUSION

According to the current study results, CRP result is more sensitive than ESR and WBC tests in diagnosis of COVID-19 and can be applied in screening.

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## Conflicts of interest

None declared.

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