

Review Article: Laboratory Tests and Their Role for Detecting Covid 19 Infection

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ABSTRACT

Corona Virus Disease or what is known (Covid 19) is pandemic spread quickly among most countries of the world, where the infections reached to 50 million humans, and more than 1.250.000 deaths. The reasons of the disease spread among people are the infected and not taking adequate preventive procedures. The delay of the laboratory test result to confirm infection also contributes in the disease spread. Examples of the test are RT-PCR, which requires a lot of time, accuracy in the work, and high experience techniques. These conditions are not available in almost countries, which do this test for limited people with clear symptoms. In this research, some Laboratory tests are concerned to show their role in detecting the virus, where the result of this study show that the results of RT-PCR test are inaccurate by 20%, and so most of the countries that suffered from the rapid spread of the virus resorted to relying on other laboratory tests that less cost and give a quick results to early detection of the virus infection, and these tests can identify false results of RT-PCR.

Keywords- RT-PCR, Corona Virus Disease, Lymphocytes, Eosinophils, Basophils.

I. INTRODUCTION

Corona viruses include collection of viruses that infects the humans and animals together. Among these viruses, viruses that infect the respiratory system, sometimes causing simple and common cold symptoms or severe symptoms, including the Middle East Syndrome and Respiratory Syndrome (SARS). In December 2019, a new virus appeared in the Wuhan-China city that spread between the populations, it have symptoms similar to those of influenza infection. This disease was known as (Covid 19), it belongs to the Corona family, and the disease quickly spread among a large number of countries in the world, turning into a pandemic that invades all countries [1]. At a time when the world is try to find a vaccine for the Covid 19, thousands of people are infected daily with the virus, whose infections range from light, medium and critical, in addition to the presence of a very large number of deaths as a result of infection with the virus, especially the elderly who suffer from underlying health problems such as respiratory diseases [2]. According to studies that done in the period of spreading the disease, there are many methods for diagnosing the virus between developing and developed

countries, some of which have proven effective, including those that give false or negative results. Some accurate tests requires a modern techniques that are not available in some countries and also requires long period for appearing the results, and this is not suitable with thousands of patients go to the hospitals and health centers, such these tests is RT-PCR. Waiting for the results of this test is a waste of time, therefore, some countries used another test that is blood count test, especially a white blood cell count, which is a fast, accurate, cost-effective, and less time to determine if you have the virus (Covid 19) [3]. The world countries used rapid and effective laboratory medical tests to detect early infection with Coronavirus. The aim of this paper is to evaluate the efficiency of some laboratory test for early detection of infection with Covid 19. This study introduces comparative study of some previous work that used different laboratory tests.

The paper organize as follow: section II illustrates most popular and effective laboratory tests used for diagnose the disease. Most Literature survey produced in Section III. The final section in this paper presents the results and conclusion.

I. Laboratory analyzes

Listing below some laboratory tests that are used for diagnosing COVID-19 virus:

1. Complete Blood Counts (CBC)

It is the most frequently laboratory test that is required for measuring the number, types, percentage, and concentration of cells that vary according to gender and age. Tests that are part of a CBC include the following:

- **Red Blood Cell Count (RBCs):** This test includes the following subtest: Hemoglobin (HB)Hematocrit (Hct), Red blood cell indicators, Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), and Mean Corpuscular Hemoglobin Concentration [4].

- **White Blood Cell Count (WBC):** White blood cells are the most important part of the immune system [4], and their primary role is to protect the body from infection. Total white blood cell count of six different types of cells. The total white blood cell count can be abnormally high or low as a result of changing one or more of the component subtypes [5]. WBC comprise:

- ✓ **Lymphocytes** are important components of the immune system. The number of lymphocytes increases in cases of viral and bacterial infections [6].

✓ **Monocytes:** The monocyte count increases in chronic inflammatory disorders and in infections [7]. Low monocyte counts can be seen with steroid medication [5].

✓ **Eosinophils:** The cases of increasing eosinophil count are in parasitic infections, allergic disorders, asthma, and eczema [8].

✓ **Basophils:** it is another important component of the immune system. Levels of basophils are increased in some types of leukemia and inflammatory conditions [5]. The number of basophils may decrease in cases of prolonged corticosteroid therapy and hyperthyroidism [5].

• **A platelet count**

Is a small part of the cells involved in the blood clotting process [9]. Causes of increased platelet production include infections, tissue damage, some medications, and some bone marrow diseases [7]. Table No. (1) shows the normal ratio of the CBC test.

2. C-Reactive Protein (CRP)

It is one of the reactive indicators that have a protein composition secreted by the liver as a result of exposure of the body to any bacterial or viral infection, as the level of CRP rises and reaches thousand times from its concentration due to the occurrence of acute infections, and the high concentration can lead to the occurrence of various symptoms include pain, fever, and other clinical symptoms [10]. The CRP test, measures the concentration of CRP in the blood, sometimes this test used to differentiate bacterial infection from a viral infection, where its concentration is found to be higher in a bacterial infection. CRP concentration is developed in cases of a chronic disease and presence of inflammation, but it does not determine the cause of the inflammation, and this indicates the lack of specialization of this test [11]. There are two types of measurements for this protein include the *standard* that measures high concentrations of this protein in the blood of (10-1000) mg/liter and the *HS-CRP* test, which accurately measures the lower concentrations of protein (0.5-10 mg/liter) [12]. Significantly, COVID19 increase the levels of the reactive protein due to the inflammatory reaction, and high concentrations indicate the severity of the disease, and when its concentration decreases, the inflammatory stimulus of the patient decreases, and the patient is cured [10]. A study showed that CRP concentration increased with the severity of infection with (H1N1) virus [11].

3. Antibody Test

It is protein bodies that are secreted by the immune system into the blood as an immune response. [13] it is not known how long these protein bodies will remain in the body of a Covid 19 recovered, so the recovered person should not act as if he has not infected again [14] This test gives a positive result, which indicates that your body contains antibodies against Covid 19, indicating that you were previously infected, or the result may appear positive even if symptoms of infection do not appear, but in some cases the positive result may be incorrect Because of the low quality of the test, the negative result means that there are no antibodies to

Covid 19, meaning that you did not become infected, as the immune system takes days to weeks to produce the antibodies, and negative results may appear incorrect in other cases as a result of the test that is done after a period of infection Short or due to lack of test quality [15]. The antibody test may be useful and quick to give a result about infection with Covid 19, but it is imprecise about the possibility of gaining the body immunity against the virus. Therefore, researchers resorted to conducting studies on the immunity of (T cells), cell as these cells are characterized by the ability to recognize viruses and kill infected cells, but it takes This test is a long time and requires high technical and artistic capabilities[16]

4. Real-Time CPR

It is one of the most important techniques used in medical and biological research laboratories to detect genetic diseases, determine the genetic fingerprint and diagnose infectious diseases through the detection of the genetic material any type of pathogen and to detect viruses, especially viruses have genetic material RNA, the RNA must be converted into DNA by a process of Reverse replication, because DNA is the only DNA that can be amplified [17]. This technique has been used extensively to detect Coronavirus (Covid 19), it is considered one of the most accurate methods that give accurate results to determine the infection. The sample is treated with several chemical solutions that remove substances such as proteins and fats and that extract only the RNA present in the sample, in an RT-PCR machine. [18]. The mixture is subjected to a process of raising temperatures to 94 ° C and then lowering the temperature to stimulate specific chemical reactions that produce new identical copies of the target sections of the viral DNA. Each cycle doubles the previous number: two copies become four, four copies become eight, and so on. The real-time standard RT-PCR setup usually goes through 35 cycles [19]. The parameters are attached to the DNA strands and then a fluorescent dye is released, which is measured by the instrument computer. A computer tracks the amount of fluorescence in the sample after each cycle. When a certain level of radiance is exceeded confirms the presence of the virus, Scientists also monitor the number of cycles it takes to reach this level to estimate the severity of infection [17], although this technique is characterized by accuracy, the results may be false negative or false positive, and this is due to the lack of test quality or insufficient artistic expertise of the workers on sampling the device [19].

II. LITERATURE SURVEY

In this section, some related works that concerns with using laboratory tests are explained. As follow:

The (CBC) test was considered one of the first analyzes that were used for early detection of the Coronavirus with the increase in infections that reach thousands within hours only, which gives quick and

significant results for infection. In the study [3] 207 patients were used and the samples were classified into 105 positive results for the Coronavirus test and 107 the result is negative, using a PCR test. It was observed that the blood lymphocytes and neutrophils decreased in the positive group, while the blood platelet values did not increase. The study Yishan Zhang et al, [2020] found a sharp decrease in the value of blood platelets in acute and non-severe cases of infection with Covid 19, used 125 people 103 of them infected with Coronavirus (Covid 19) and 22 people with pneumonia other than Covid if it was found. Also the lack of lymphocytes in cases of infection with Covid 19 and another study divided the patients into two parts: A section infected with 50 Covid and a section afflicted with influenza included 50 patients, 30 patients from the Covid group were found to have zero eosinophil's and 17 of them had a hot low in eosinophil's and 2 normal rates 1 elevation while only 8 of the influenza group were found to have a low acid count. After two days of symptoms, an additional 14 patients had eosinophil's decreased, and within two days 44 died, 23 of the corona group, 18 out of 21 who had suffered from Lack of WBC compared to 13 of the 26 survivors who suffered from lack of WBC when symptoms appeared. This means that a lack of WBC is associated with the severity of the disease. A count of eosinophils help predict disease and restore their number, helps predict recovery [6]. Another study depend a group of Covid patients and divided them into four groups depending on the severity of the disease after measuring CRP and measuring the diameter of the lung using CT-scan in the first days of the disease, and the result was the concentration of CRP In the moderate group, it was higher than in the mild group, in the severe group, higher than in the mild group, and the critical group, higher than in the severe, so CRP was significantly associated with the severity of infection with the virus [13]. CRP was used to indicate early infection with Covid 19, as it was found that its concentration increases in infected people and the focus increases with the severity of the disease, and this is what was found in the study [5], as it was found in another study to increase the concentration of reactive protein in cases of acute and non-acute infection of Covid 19 [6]. However, other studies showed the effective role of antibody testing in early detection of infection with the virus, including a study that included 40 people with Covid 19 compared to 50 uninfected people. (IgM, IgG) were measured. These antibodies were found in 34 of the 40 infected from The Covid 19 group, while not noticing its presence in the healthy

comparison group, was later found that (IgG) was present in 31 of the Covid 19 group in the first days of Appearing symptoms, and then its concentration increased within 3 weeks of infection and then decreased after 8 weeks [18] in another study The rates of antibody-positive (IgG, IgM, or both) were in the first 5 days of symptom onset, and then increased after the 10th day appearing symptoms [19]. However, a second study found that (IgM) was higher in the first days of illness and then decreased a month later [20]. several studies conducted to prove the efficiency PCR detecting infection with the virus, including a study that showed that there should be parallel tests, including computed tomography (CT-Scan) and (PCR), to reduce the error that occurs in the tests [21]. In another study, a total of 36 patients were diagnosed with Covid-19 pneumonia. Thirty-five patients were abnormal according to CT results in the first days of onset of symptoms, while one patient underwent a normalized CT scan. When using rRT-PCR, 30 patients who tested positive were used, with 6 cases not detected initially. Of these six patients, 3 patients became positive on the second rRT-PCR test (after 3 consecutive days) and only the other three became positive in the third round of rRT-PCR tests after 8 days in a row, The sensitivity of the CT was 97.2%, while the sensitivity of rRT-PCR was 83.3% so rRT-PCR may produce false-negative primary results[22]. In addition, from it, there should be other tests, including CBC and CRP, and antibody tests to confirm infection, as well as a CT scan to detect the percentage of organ damage as a result of infection with the Corona virus.

III. RESULTS AND CONCLUSION

Many laboratory tests have proven their efficiency in early detection of infection with the Covid 19 virus, especially in developing countries that do not have the ability to conduct high-cost analyzes to detect infection for all patients, so the reliance of these countries on some tests are known for their low cost and fast results are also These analyzes can be used as an alternative to PCR as they have proven efficient in detecting the validity of the PCR test results, Sometimes the results of this test are found to be inaccurate, which leads to giving false results. Therefore, these tests (CBC, CRP, antibody test) can be adopted for early detection of infection With Covid-19 virus and also to determine false results test PCR.

Table 1: Shows the normal ratio of the Complete Blood Count CBC test [23]

Test	Alternative Names	Usual Normal Range
Hemoglobin	Hb or Hgb	Males: 13.6-17.5 g/dL Females: 12-16 g/dL
Hematocrit	Hct	Males: 39%-49% Females: 35%-45%

Red Blood Cell Count	RBC	Males: 4.3-5.9 x106/mm ³ Females: 3.5-5 x106/mm ³
Mean Corpuscular Volume	MCV	80-100 mm ³
Mean Corpuscular Hemoglobin	MCH	24-34 pg
Mean Corpuscular Hemoglobin Concentration	MCHC	33-37 g/dl
Platelet Count	Plate	150-450 × 103/mm ³
Total White Blood Cell Count	WBC or WC	4.5- 11 × 103/mm ³
Neutrophils)		60-70% or 1.8-7.7 x103/mm ³
Lymphocytes	Lymphs	25-40% or 1.0-4.8 x103/mm ³
Monocytes	Monos	2-8% or 0-0.8 x103/mm ³
Basophils	Baso	0-1% or 0-0.2 x103/mm ³
Eosinophils	Eos	2-8% or 0-0.8 x103/mm ³

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