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Changes in Haematological Parameters among COVID-19 Patients

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ABSTRACT

Corona Virus Disease 2019 (COVID-19) is the pandemic world crisis that causes the most dangerous health and economic disaster since the second world war. The world health organization (WHO), in February 2020 has announced about the new epidemic disease caused by 2019-nCoV: 2019 Coronavirus Disease (COVID-19). Several health problems were associated with COVID-19 infection including; dry cough, fever, fatigue, headache, haemoptysis, diarrhoea, dyspnoea, and lymphopenia. COVID-19 infection was associated with death especially among older patients. Coronaviruses can infect bone marrow cells leading to abnormal blood production and synthesis (haematopoiesis). Thus, several changes have been reported in haematological parameters among COVID-19 patients. Yet, the mechanisms by which this virus delays and inhibit the hematopoietic system are not clear. This review was aimed to focus on the most common laboratory changes within the haematological parameters including; white blood cells, lymphocytes, platelets and other.

Key Words: COVID-19, Haematological parameters, WBCs, Lymphocytes, Thrombocytopenia

INTRODUCTION

Corona Virus Disease 2019 (COVID-19) is the pandemic world crisis that causes the most dangerous health and economic disaster since the second world war. The world health organization (WHO), in February 2020 has announced about the new epidemic disease caused by 2019-nCoV: 2019 Coronavirus Disease (COVID-19)¹. The COVID-19 was reported as a very highly spread virus, however, some transmission method between patients and healthy person is still unclear². It has been estimated that the median incubation period (the period from exposure to the appearance of the symptoms) for COVID-19 is between 2 and 14 days³. Several health problems were associated with COVID-19 infection including; dry cough, fever, fatigue, headache, haemoptysis, diarrhoea, dyspnoea, and lymphopenia^{4,5}. Moreover, rhinorrhoea, sneezing, and sore throat was found as unique clinical features⁷. COVID-19 infection was associated with death especially among older patients. Many studies were reported that the period from onset of symptoms among COVID-19 infected patient to death ranging from 6 to 41 days. Whereas this period is varying according to many factors such as the

patient's age and patient's immune system status. Patients aged 70-years old and more were reported with a shorter period between the onset of COVID-19 symptoms and death⁸.

Coronavirus and total white blood cells level

Clinical laboratory investigations are essential to confirm COVID-19 infection and also to follow up patient's health status. It has been found that coronaviruses can infect bone marrow cells leading to abnormal blood production (haematopoiesis)⁹. Thus, several changes have been reported in haematological parameters among COVID-19 patients. Yet, the mechanisms by which this virus delays and inhibit the hematopoietic system are not clear.

From day one to fourteen while the incubation period and none of the symptoms are presented, the total white blood cell (WBC) count is normal or slightly decrease¹⁰. Following the incubation period, Ding and colleagues, reported low white blood cell count (leukopenia) in more than 25% of hospitalized patients with COVID-19¹¹. The result of a retrospective study performed on asymptomatic patients under 18 years old in the recovery period showed a low

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level of white blood cells among 20% of patients¹. Within the same study, an increase in lymphocytes in 18.75% of patients was reported¹. Another study done to investigate the level of WBCs among hospital admitted patients with COVID-19 and showed that leukopenia developed in 20% of patients¹². A more recent study in Hanchuan City People's Hospital showed decreased WBCs account among the vast majority (99%) of COVID-19 infected patients¹¹.

Coronavirus and lymphocytes level

Regarding the level of lymphocytes in COVID-19 infected patients, normal or slightly low level was reported among patients during the incubation time¹⁰. However, low level of lymphocytes was detected in 83.2% of hospital admitted patients¹⁰. A significant association between low lymphocytes count and requirement of intensive care unit (ICU) admission was reported by Wu and his colleagues¹³. In Washington state, decreased level of lymphocytes was highly reported with seriously ill COVID-19 patients in ICU¹⁴. Also, low lymphocytes count was more commonly reported in ICU patients compared to the non-ICU patients. Thus, low lymphocytes level might be considered as an important indicator for early admission for supportive ICU care. Neutrophils are one of the immune cells which, protecting human bodies during bacterial or fungal infections by phagocytosis¹⁵. Huang et al. highlighted an increased level in neutrophils in patients with COVID-19 who is admitted in ICU⁴. High risk of development of acute respiratory distress syndrome (ARDS) and the mortality rate was significantly ($P < .001$) associated with high neutrophils level¹³.

Coronavirus and thrombocytes level

In Beijing, 72.5% of COVID-19 patients developed thrombocytopenia among 13 patients from three hospitals, however, the reduction on platelet count did not reach to the level at which bleeding happens¹⁶. Low platelets level (thrombocytopenia) was noted among COVID-19 patients on admission and ICU patients in 552 hospitals in 30 different provinces in China¹⁷. On the other hand, another study reported non-significant differences in platelets level between ICU patients and non- ICU patients⁸. Similarly, no significant changes in platelets level between COVID-19 patients with ARDS and patients without ARDS as reported in Wu's study¹³. Xu and colleagues were reported three hypothesized mechanisms causing thrombocytopenia. The first mechanism by causing direct viral infection of bone marrow cells and impairing of platelet synthesis. Also, the decrease of platelet synthesis indirectly as a result of lung injury. The second mechanism is through the body's immune system. The third hypothesized mechanism is by aggregation Of platelet in the lungs, leading to platelet consumption and microthrombi¹⁸.

Coronavirus and coagulation parameters

Other common alterations in haematological parameters in patients with COVID-19 are including; prolonged activated partial thromboplastin time (APTT) as well as elevated D-dimer levels. Such coagulation parameters were markedly higher among COVID-19 patients compared with healthy controls individuals. On the other hand, the majority of patients with COVID-19 infection were investigated with normal prothrombin time (PT)¹⁹. Several studies have been reported abnormality in D-dimer levels^{19,20}. It has been shown that 28.6% of COVID-19 patients investigated with high D-dimer levels in the University of Hong Kong-Shenzhen Hospital²¹. Additionally, the complications and severity of the disease among patients with community-acquired pneumonia was significantly associated with D-dimer elevated levels²². Thus, higher D-dimers level is associated with patients WHO requiring ICU treatment and more severe cases²⁰.

CONCLUSION

In conclusion, since the World Health Organization announced virus Corona is a global pandemic the virus is still spreading strongly affecting and killing thousands of people around the World. Currently, scientific information about the disease and the nature of its spread is still not well known. Thus understanding pathophysiology of the disease to develop an effective treatment for the virus is still a challenge for the human being. Laboratory tests are an important factor in the diagnosis and treatment of the disease. According to the literature review, haematological parameters are changeable according to the course of COVID-19 infection and that some of them can be a sign of poor outcomes that may lead to death. Leukopenia, thrombocytopenia, lymphopenia, and coagulation abnormalities are the most notable haematological manifestations. However, this review article has some limitations. Because COVID-19 is considered a recent pandemic.

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