

Peripheral blood abnormalities in patients with Covid 19 hospitalized in the pneumology department of Marrakesh University Hospital

Selma Abdala *, Salma Aitbatahar and Lamyae Amro

Faculty of Medicine and Pharmacy, Cadi Ayyad University, Department of Pneumology, ARRAZI Hospital, Mohamed VI University Hospital Center, Marrakesh, Morocco.

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Abstract

In December 2019, Coronavirus 2019 due to *SARS CoV 2* was first discovered in Wuhan, China and then rapidly spread to more than 200 countries. Until now, there is no specific vaccine and no effective treatment, so it is very important from a clinical point of view to predict the evolution of the disease. Thus, in order to further analyze the value of the clinical application of blood count parameters in the diagnosis or management of COVID-19 (Coronavirus disease 2019) patients. Peripheral blood abnormalities of 102 COVID-19 patients hospitalized in the pneumology department of CHU Mohamed VI in Marrakesh were analyzed retrospectively and compared to *SARS CoV 2* negative patients. Results: WBCs in the patient group were $8.32 \times 10^9/L$ vs $5.85 \times 10^9/L$, $p < 0.001$, an elevated neutrophil count ($5.33 \times 10^9/L$ vs $3.27 \times 10^9/L$, $p < 0.001$), a lower hemoglobin concentration ($13.5 [10.6-16.37]$ g/dl vs $14.8 [13.5-15.6]$ g/dl, $p < 0.001$), and a higher Neutrophils-to-lymphocytes ratio (2.63 vs 1.52 , $p < 0.001$). The severe cases had a higher white blood cell count ($14,279 (\pm 6,564)$ vs. $7,471 (\pm 2,609) \times 10^9/L$, $p < 0.001$), a much higher neutrophil count ($12,547 (\pm 6,698)$ vs. $4,468 (\pm 1,882) \times 10^9/L$, $p < 0.001$). Lymphopenia ($0.851 (\pm 0.406)$ vs. $2.138 (\pm 1.103) \times 10^9/L$, $p < 0.001$), NLR (14.74 vs. 2.08) and Platelets-to-lymphocytes ratio (145 vs. 117) were higher than the non-severe COVID-19 cases. Conclusion: In light of these data, we deduce that regular monitoring of blood counts should be involved to judge the progression and prognosis of COVID-19.

Keywords: Peripheral blood; *SARS CoV 2*; Neutrophils; Lymphocytes

1. Introduction

In December 2019, Coronavirus 2019 due to *SARS coV 2* was first discovered in Wuhan, China and then rapidly spread to more than 200 countries. As of July 1, 2020, according to the World Health Organization (WHO), there were 10,357,662 confirmed cases of Covid-19 and 508,055 deaths. Until now, there is no specific vaccine and no effective treatment, so it is very important from a clinical point of view to predict the evolution of the disease. Previous studies have shown that neutrophil/lymphocyte and platelet/lymphocyte ratios are predictive of infectious disease progression [1,2], a study by Guan et al. of 1099 patients with COVID-19 showed abnormalities in the hematopoietic peripheral blood system of some patients [3]. Thus, in order to further analyze the value of the clinical application of these blood parameters in the diagnosis or management of COVID-19 patients, the peripheral blood abnormalities of 102 COVID-19 patients hospitalized in the pneumology department of CHU Mohamed VI of Marrakech were analyzed retrospectively, which is reported below.

* Corresponding author: Selma Abdala

Faculty of Medicine and Pharmacy, Cadi Ayyad University, Department of Pneumology, ARRAZI Hospital, Mohamed VI University Hospital Center, Marrakech, Morocco.

2. Patients and methods

2.1. Diagnostic Criteria

All Covid-19 cases were confirmed by the use of RT-PCR on nasal swab specimens.

Patients with hemopathy or who received a blood transfusion during hospitalization were excluded from the study.

2.1.1. The COVID-19 cases were divided into two categories according to severity: mild to moderate and severe cases, the latter representing at least one of the criteria listed below

- Neurological Disorders: Disorders of Consciousness
- Polypnea: FR> or equal to 30 cycles per min.
- Systolic BP <90 mmHg
- Heart rate: >120 beats/min
- Oxygen saturation < 92% under 4l/ min O₂

Blood samples for blood counts (CBC) of patients with COVID-19 were taken on admission.

The control group had an RT-PCR for SARS CoV-2 which was negative.

Data entry was performed on Excel 2013, with a uni-variate descriptive method using percentages and averages. The software used for the p-value is epi info 7.2. A value of p<0.05 is considered statistically significant.

3. Results

3.1. Hematopoietic profile of patients with COVID-19 at admission

Of the 102 patients with Covid-19, most had abnormalities in peripheral blood parameters when compared to the control group.

Table 1 Blood counts in COVID 19 patients at admission and controls

Variations	Covid-19 cases (n = 102)	control cases (n= 38)	P value
Age	43,73	42	0.5
Male vs female	54,16% vs 45,83 %	52.8% vs 47.2%	0.7
Leukocytes ($\times 10^9/L$)	8.32 (6.57-10.08)	5.85 (5.16–6.76)	<0.001
Neutrophils ($\times 10^9/L$)	5,33(4,2-6,45)	3.27 (2.61–3.94)	<0.001
Lymphocytes ($\times 10^9/L$)	2,02(1,58-2,45)	2.15 (1.83–2.34)	0.29
Hemoglobin (g/dl)	13,5 (10,6-16,37)	14,8 (13,5–15,6)	<0.001
Platelets ($\times 10^9/L$)	251 (340-162)	266 (215,4—316,6)	0.3
NLR	2,63	1,52 (1,42—1,68)	<0.001
PLR	124,2	124 (117,5—135)	0.4

WBCs in the patient group were $8.32 \times 10^9/L$ vs $5.85 \times 10^9/L$, $p < 0.001$, an elevated neutrophil count ($5.33 \times 10^9/L$ vs $3.27 \times 10^9/L$, $p < 0.001$), a lower hemoglobin concentration ($13.5 [10.6-16.37]$ g/dl vs $14.8 [13.5-15.6]$ g/dl, $p < 0.001$), and a higher NLR (2.63 vs 1.52, $p < 0.001$).

There were no significant differences in age, sex ratio, lymphocyte and platelet counts between the patient and control groups (table 1).

Severe cases had a higher white blood cell count (14,279 ($\pm 6,564$) vs. 7,471 ($\pm 2,609$) $\times 10^9/L$, $p < 0.001$), a much higher neutrophil count (12,547 ($\pm 6,698$) vs. 4,468 ($\pm 1,882$) $\times 10^9/L$, $p < 0.001$). Lymphopenia (0.851 (± 0.406) vs. 2.138 (± 1.103) $\times 10^9/L$, $p < 0.001$), inflammatory anemia was noted (11.1 (± 2.4) vs. 13.6 (± 2.7) g/dl, $p < 0.001$), NLR (14.74 vs. 2.08) and PLR (145 vs. 117) were higher than the non-severe COVID-19 cases. There was no significant difference in platelet levels between the two groups (Table 2).

Table 2 Blood counts in patients with non-severe and severe Covid-19 on admission

Variations	Mild to moderate Covid-19 cases	Severe Covid-19 cases	P value
Average age	41,5 (± 17.7) ans	61,4 (± 15.9) ans	<0.001
Leukocytes ($\times 10^9/L$)	7.471 (± 2.609)	14.279 (± 6.564)	<0.001
Neutrophils ($\times 10^9/L$)	4.468 (± 1.882)	12.547 (± 6.698)	<0.001
Lymphocytes ($\times 10^9/L$)	2.138 (± 1.103)	0.851 (± 0.406)	<0.001
Hemoglobin (g/dl)	13,6 (± 2.7)	11,1 (± 2.4)	<0.001
Platelets ($\times 10^9/L$)	255 (± 110)	240 (± 90)	0.3
NLR	2,08	14,74	<0.001
PLR	117	145	<0.001

4. Discussion

COVID-19 is a systemic disease causing multiple organ damage, caused by *coronavirus 2 (SARS-CoV 2)*, with the lung as the main target organ. It can cause severe lung damage and acute respiratory distress syndrome (ARDS) in severe cases that can lead to death [3]. The virus binds to the ACE2 receptor and enters the alveolar epithelial cells [4], causing the cells to release inflammatory factors and activate the numerous macrophages in the alveolar tissue; the macrophages then induced factors and chemokines, which recruit large numbers of mononuclear immune cells to aggregate and infiltrate the lung tissue; this additional immune activation leads to a storm of inflammation and tissue damage [5].

The significant decrease in lymphocyte numbers in patients with COVID-19 may be related to the redistribution and increased consumption of lymphocytes and defective hematopoiesis [6]. Li et al. found that bacterial *pneumonia* is added to some deaths due to COVID-19 [9]. This explains the significant increase in leukocyte and neutrophil counts. It has been reported that *SARS-CoV 2* causes damage to ACE2 receptor-rich kidney tissue and an increase in inflammatory factors, which can lead to reduced erythropoiesis and destruction of red blood cells, leading to anemia [8].

In our series, blood count parameters in patients with COVID-19 were significantly abnormal. Among them, increased white blood cell count and neutrophil counts, decreased lymphocyte count was most evident in severe Covid 19 cases. Hemoglobin was also significantly lower than that of the healthy control group. The combined peripheral blood parameters, including NLR was significantly increased. This indicates that monitoring changes in routine blood parameters had a important clinical significance. Studies have shown that the progression and prognosis of COVID-19 is related to the body's immune status and excessive inflammatory response [8]. In this study, by comparing and analyzing routine peripheral blood parameters of the Covid 19 in non-severe and severe groups, it was found that the absolute value of lymphocytes in the severe group was significantly lower than that of the non-severe group, while the number of inflammatory neutrophils in the severe group was much higher than that of the mild group. These changes showed that the degree of inflammation had further intensified, triggering an inflammatory storm and leading to increased tissue and cell damage [10]. Low lymphocyte levels and impaired immune cell function cause a dysfunction of the immune system, so patients with severe COVID-19 may be more susceptible to bacterial infection [11]. The NLR blood cell parameter reflects this situation, and we therefore believe that NLR has some value in judging the severity of COVID-19. Our results are consistent with those of Qin et al [12]

5. Conclusion

In light of these data, we find that COVID-19 will cause abnormalities of the hematopoietic system. The most obvious abnormalities are lymphopenia, increased leukocyte count and NLR ratio, which are re-evaluated according to the severity of the disease and clinical classification. Thus, regular monitoring of blood counts should be involved to judge the progression and prognosis of COVID-19.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Permission to conduct the study was obtained from Cadi Ayyad University, Department of Pneumology, ARRAZI Hospital, Mohamed VI University Hospital Center, Marrakesh. Informed consent was obtained from patients. All patients' information including raw data was kept confidential during and after study period.

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