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Changes in Some Haematological Indices among Covid-19 Patients in Parts of Imo State, Nigeria

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Abstract

This study on changes in some haematological indices among COVID-19 patients was conducted in parts of Imo State between the months of August 2020 to December 2021. A total of seventy-five (75) blood samples from patients that tested positive for SAR-COV2 were used for the study. The blood samples collected were analysed using standard haematological procedures i.e polymease chain reaction (PCR) was used for viral identification while haematology analyzer was used for haematological parameters. The study revealed a significant increase in white blood count (WBC) in severe patients (12.5 × 10^9/c). When compared with the control group (8.2 × 10^9/c) at ($p<0.05$). The result of the study also revealed a significant increase in monocyte, Eosinophil are Basophyl count in severe cases (20.0%, 27.0% and 18.0%) critical cases (25.0%, 30.0% and 27.0%) respectively when compared with the control group (6.0%, 8.0% and 3.0%) at ($p<0.05$). Also, there was a significant decrease in lymphocyte (29.0%) and CD4 (500 cell/mm^3) count respectively among patients who were in critical condition. The mean platelet count (135 × 10^9/L) and red cell distribution width (58.0%) among COVID-19 patients in critical condition decreased significantly when compared with other groups at ($p<0.05$). The highest number of COVID-19 patients in critical condition were recorded in the age group 61 – 70 years, followed by the age group 51 – 60 years. Therefore, from the result of the present study, it is obvious that COVID-19 can alter some vital haematological parameters. If these alterations are not properly managed, it can lead to high mortality among infected patients.

Keywords: COVID-19, Haematological Indices, Changes, Imo State, Patients.

Introduction

Corona viruses are envelop virus containing an unsequented genome of positive sense, single stranded RNA of about 27 – 30Kb with a helical nucleo capsid (Janof, 2022). Generally, corona viruses are known to infect animals and not man, but they mutated in a way that allows them to infect man and scientist described them as human corona viruses (HCOVS).

In the year 2019, a novel corona virus (SARS-COV2) was discovered in Wuhan, China and this was responsible for Coronavirus disease 19 (COVID-19). It infected millions of people

globally including Nigeria where the first case was announced on the 27th of February, 2020 when an Italian Nationale in Lagos tested positive to the virus (NCDC, 2020).

SARS – cov -2 virus enters the human host cell through the S-Spike protein by binding to ACE 2 aided by TMPRSS 2 protease. The high replication cycle and infectively of the virus could be linked to mutations in the receptor binding domain and the acquisition of a furan cleavage site in the S-spike protein. The interaction of the virus with ACE 2 could alter the anti-inflammatory functions and raise the angiotension II effect in Predisposed patients (Liuetal, 2020).

The invasion of the lung cells myocytes and endothelial cell of the vascular system by the virus results in inflammatory changes oedema and necrosis. These changes are mainly related to pro-inflammatory cykokines, including interleulkin in (IL)-6 IL 10 and tumor necrosis factor agronucleoyte colony stimulating factor, monocyte, chemoattractant I, protein I, macrophage, inflammatory protein Ia and increased expression of programmed cell death.(Wong et al 2020)

These changes constitute to lung injury hyproxia – related myocyte injury increased damage of myocardial cells and cardio pulmonary changes. The cardiovascular system is most frequently involved in covid-19 infection. The inflammation of the vascular system usually results is myocarditis i.e an inflammation of the cardiac muscle cardiac arrhythmias, heart failure and death. (Rizzo et al, 2020)

The generalized clinical symptoms of covid-19 include dry cough shortness of breath which maybe severe and progressive especially when the patient develops pneumonia, myalgia, tiredness, sore throat, nausea vomiting, and diarrhea. (Liu et al, 2020).

The patients may also present with neurological symptoms, cardiovascular diseases, headache, dizziness seizure, decrease level of consciousness and confusion (Rizzo et al, 2020).

Recently, there has been reported cases of gastro-intestinal manifestations of Covid-19 including diarrhea vomiting and abdominal pain. SARS – COV – 2 RNA has been isolated from stool, anal and rectal swabs (XU et al, 2020).

ACE2 has been reported to be present in the epithelial cells of the gastro-intestinal tract and this tends to suggest a viral entry through the ACE 2 receptors and the replication always results to inflammatory changes. Because of the nature and severity of this pandemic, WHO is 2021 declared it a global emergency.

In tandem with this ideology, most presidents declared and implemented a total lockdown in their countries including Nigeria. This impacted negatively on our economy and so many lives were lost thereby living many children as orphans.

Since COVID-19 is transmissible form person to person through physical contact and droplets, it is important to advocate proper use of face mask, good personal hygiene and vaccination of the populace.

Statement of Problem

Coronavirus disease (Covid 19) is an infectious disease caused by the SARS – COV-2 virus. Most people infected with the virus experience mild to moderate respiratory illness and may recover without requiring special treatment. Some require medical attention. Older people and those with some comorbidities like diabetes, chronic respiratory disease, hypertension are more lively to develop very serious complications. Anybody can get sick with Covid-19 and became seriously ill or die at any age.

Complications that usually result to death are always associated with altered immune cells and some molecular proteins. Some people who has severe covid-19 infection suffer multiple organ defect that may finally result to death.

Study Objectives

1. To analyze some haemalogical parameters in COVID-19 and control patients.
2. To determine the alteration in these parameters in COVID-19 and control subject.
3. To compare these alterations to haemalogical parameters in COVID-19 patients and control groups.

Research Questions

1. Can COVID-19 disease cause death?
2. Can COVID-19 disease be treated?
3. Can COVID-19 disease be diagnosed and monitored through laboratory investigations?

Materials and Methods

Study Area

The study was carried out in Imo State, Nigeria. Imo state is one of the South Eastern states. It is located on the latitude of 5˚ 21^{1}N, 7˚ 2^{i}E with a temperature range of about 20˚ C - 30˚ C. with relative humidity of about 33 – 57 % during rainy season. The state comprised of three senatorial zones namely Owerri, Okigwe and Orlu with total of 27 local government areas.

There are seventeen (17) General and two teaching hospitals. The inhabitants are mainly Ibos while farming and trading are their main occupation.

Study Group

This group comprised of seventy-five (75) patients (45 males and 30 females) that tested positive for SAR-COV2 with PCR and were admitted in isolation centres in Owerri. The overall ages were between 30 – 70 years, whereas demographic information such as gender and age were also recorded.

Control Group

This group comprised of 50 (25 males and 25 females) aged 25 – 60 years who volunteered to be used as control. Their informed consents were also obtained.

Ethical Consideration

Ethical clearance was obtained from ethics committee for research and development of the institution.

Inclusion Criteria

Patients that tested positive for SARS-COV2 in line with WHO and CDC guideline for diagnosis of COVID-19 were included in the study.

Sample Collection

About 5ml of venous blood was collected from the patients, one week after admission in isolation centres using EDTA bottles. The blood samples were analysed using automatic haematology analyser (SYS MEX Xp 300) for FBC, MCV, MCH, MCHC, platelets, RDW and PDW.

The CD4 cells were counted using flow cytometer.

Statistical Analysis

Student's t-test as well as ANOVA were used in the analysis. A p-value of less than 0.05 was considered significant.

Results

The result of the study revealed a significantly raised white blood cell count (WBC) in severe (12.5×10^9/L) and critical cases (13.5×10^9/L) when compared with the control group (8.2×10^9/L) at ($p<0.05$). The study also revealed a significant increase ($p<0.05$) in the monocyte, eosinophyl and basophyl counts in severe cases 20%, 27.0% and 18.0%) and those in critical condition (25.0%, 30.0% and 27.0%) respectively when compared with the control group (6.0%, 8.0% and 3.0%). Similarly, there was a significant decrease ($p<0.05$) in the lymphocyte count in severe (20.0%) and critical (29.0%) cases when compared with the control group (59.0%).

The CD4 count was significantly lower in critical patients (500 cells/mm^3) than the control group (1200 cells/mm3) at ($p<0.05$). The mean platelet count and red cell distribution width (RDW) in severe (135×10^9/L and 58.0%) and in critical patients (120×10^9/L and 45.0%) decreased significantly when compared with mild (198×10^9/L and 106%) and control group (210×10^9/L and 120%) respectively at ($p<0.05$).

Table 2 below represents the haematogical indices in relation to gender of the patients. From the result of the study, there was no statistically significant difference ($p>0.05$) in relation to sex of the patients.

Also, from table 3 below, the result of the study revealed a significant increase in WBC count (156 × 10^9/L), monocyte (30.0%), Eosinophyl (27.0%) and Basophyl (22.0% in the age groups 61 – 70 years when compared with the age groups 30 – 40 years (8.4 × 10^9/L, 10.0%, 12.0% and 6.0%) respectively at ($p<0.05$).

The mean platalete count and RDW decreased significantly ($p<0.05$) in the age groups 61 – 70 years (132 × 10^9/L and 49%) and the age groups 51 – 60 years (139 × 10^9/L and 45%) respectively when compared with the age group 30 – 40 years (195 × 10^9/L and 102%).

Table 1: Haematological Indices in different stages of COVID-19 Disease

Parameters	Mild stage	Severe stage	Critical stage	Control group
WBC (10^9/L)	8.2	12.5	13.5	8.0
Hb (%)	12.0	10.5	10.5	12.8
Neutrophil (%)	59	58	60	62
Lymphocyte (%)	55	20	29	59
Monocyte (%)	9	20	25	6
Eosirophyl (%)	11	37	30	8
Basophil (%)	10	18	22	3
MCV (F/L)	80	80	82	88
MCH (Fg)	34	32	30	40
MCHC (%)	35	35	34	33
CD4 (Cells/mm^3)	900	700	500	1200
Platelates	198	135	120	210
RDW (%)	106	58	45	120
PDW	11.9	11.8	10.5	13.5
Platelate to lymphyte ratio	7.9	6.75	6.31	5.30
Lymphocyte to monocyte ratio	2.77	2.9	1.06	9.83
Neutrophil to lymphocyte ratio	1.68	2.9	2.06	1.03

Table 2: Haematological Indices in relation to sex of COVID-19 patients

Parameters	Mild stage		Severe stage		Critical stage	
	Male	Female	Male	Female	Male	Female
WBC (10^9/L)	7.5	7.9	11.2	10.3	12.0	12.8
Hb (%)	12.0	10.6	9.9	8..8	9.0	8.5
Neutrophil (%)	47	40	42	38	51	47
Lymphocyte (%)	37	33	20	18	22	19
Monocyte (%)	11	8	24	20	30	32
Eosirophyl (%)	22	20	28	21	25	17
Basophil (%)	17	12	15	18	19	16
MCV (F/L)	75	68	80	72	65	77
MCH (Fg)	19	14	15	20	19	24
CD4	700	800	590	630	500	530
Platelates	180	175	110	98	118	92
RDW (%)	99	92	59	65	42	40
PDW	12.0	11.9	10.0	9.8	8.0	7.6

Table 3: Haematological Indices in relation to Age of COVID-19 patients

Age (Years)	Parameters												
	WBC (10^9/L)	Hb(%)	Nuet.	Lymph.	Mono	Esino	Baso	MCV	MCH	CD4	Platelate	RDW	PDW
30 – 40	8.4	12.6	60	49	10	12	6	75	33	950	195	102	12
41 – 50	10.5	11.0	62	46	12	10	11	72	30	870	196	92	12.5
51 – 60	10.2	10.8	59	30	31	20	18	80	32	650	139	45	11.5
61 – 70	15.6	10.0	48	22	38	27	22	79	28	580	132	49	10.5

Discussion

This study was aimed determining some alternations in the different haematological parameters among COVID-19 patients in various isolation centres in Owerri, Imo State, Nigeria. The result of the study revealed a significant increase in total white blood cell count, monocyte. eosinophil and basophil count in severe and critical COVID-19 patients.

The significantly elevated levels of total white blood cells (WBC) count and the polymorphonuclear cells could be as a result of hyper-activation of the immune system which lead to the release of these cells in response to the COVID-19 antigen.

Similarly, the study revealed a significant decline in lymphocyte count in critical patients i.e patients in (intensive care unit) when compared with the control groups. The observed reduction in lymphocyte count from the result of the study could be due to the important role played by the T-lymphocyte in cases of viral infection. Since lymphocyte depletion is

always directly associated with COVID-19 disease severity, the survival rate is always linked to the ability of the T-lymphocytes to completely destroy the infectious viral particle. Therefore, if the lymphocyte count remains low, what that implies is that the patients is still in a critical state and that the immune system is still being suppressed by the virus.

Spencer et al (2021) also reported that lymphocytopenia is always a reliable biomarker in severity of COVID—19 disease. This fact was supported by Khan et al (2021). They reported a significantly low lymphocyte count among COVID-19 patients quarantined in Pakistan hospitals. This study also recorded a significantly low CD_4 level among patients in critical state i.e. those in ICU (Intensive Care Unit). When compared with the control group. This shows that the immune system of the patients in critical state were being suppressed by the COVID-19 virus. This finding is in agreement with the report of Janoff et al (2012). They stated that in most viral infections, active immunity is key to survival of the patients. If there is a decline in CD_4 cell counts, this simply shows that the immune system of the host has compromised. Thrombocytopenia and low RDW were also recorded in this study especially among critical and severe patients. Our findings is consistent with the result of previous studies by Cooper et al (2021) in which thrombocytopenia was associated with severity of COVID-19 and death of patients. Therefore, thrombocytopenia could be used as an important indicator for disease progression. The result of the study also revealed a significant decrease in RDW among patients in critical and severe conditions.

Since RDW plays an important role in determining the severity and risk posed by COVID-19. The result of the study has demonstrated that RDW is a significant mortality predictor of severity in patients with COVID-19. The mechanism of anisocytosis includes indirect erythrocyte coagulopathy, cytopathic damage and disruption of iron metabolism due to inflammatory responses. All these contribute to impaired erythrocyte formation and decrease in RDW. This study also revealed a significant decline in lymphocyte to monocyte ratio among patients in critical state (ICU) than the other groups. This is usually an indicator of poor prognosis with an increased possibility of death among patients suffering from COVID-19.

Severe and critical patients were more of elderly patients in the age groups 60 – 70 years. This could be as a result of low immunity that is associated with advancement in age and the presence of some metabolic diseases like diabetes, hypertension and cardiovascular diseases identified in this age group.

Conclusion

This study has demonstrated that certain haematological parameters like WBC count, polymorphonuclear cells, platelets and RDW are usually elevated in patients with COVID-19. They have become useful biomarker in monitoring disease progression and deaths. Therefore, they should form part of the routine laboratory investigations in isolation centres for effective management of COVID-19.

Recommendations

1. Government should continue to sensitize the public on the dangers of COVID-19 especially on the mutated variant.
2. Use of face masks, hand washing and good personal hygiene must be encouraged.
3. Government must restore public trust and confidence in COVID-19 and vaccination through trusted channels.

Conflict of Interests

The authors have no competing interest.

References

Adepoju, P. Responses and management of COVID-19 cases in Sub-Saharan Africa. *African Journal of Infectious Diseases*, 2020, 26: 404-407.

Ballodin, MK and Cole BC. Complete blood count alterations in patients with COVID-19. *Lancet*, 2020, 163: 3310-3315.

Cooper, R.L. Jones F.K., Tony B.M, Klin Q.C. The significance of thrompocytoperia in COVID-19 and other viral infections. *International Journal of Virology and Infections Diseases*, 2021, 61: 306-312.

Gong Yu. Characterization of pediatric SARS-COV2 infection evidence of People. *Viral Shadding Nat Med,* 2020, 26(4) 502-505.

Janif MC, Kent VM, Maxwell BL, Fox, BC. The role of active immune system in survival of infected patients. *International Journal of Current Immunology*, 2022, 19:86-90.

Janif, KM. Structural and chemical composition of Corona virus. *Journal of Clinical and Microbial Infections*, 2022, 26: 301 – 358.

Klan, B.L, Jone, BC, Peel VM, Juh B.K. Prevalence of Lymphocytopenia among COVID-19 patients in Pakistan. *International Journal of Molecular Biology and Immunity*, 2021, 91:3121 – 3125.

Liu, P.P. Blet, A. Smyth D, Li, H. The science underlining covid-19: implications for the cardiovascular system. *Nature*, 2020, 436:420-430.

Nigeria Centre for Disease Control: First case of Corona Virus disease confirmed in Nigeria, 2021. Available from http://ncdc.gov.ng/new/2021/first case of corona-virus confirmed in Nigeria.

Nigeria Centre for Disease Control. Statistics of COVID-19 cases in Imo State as at December 2021. Available from http://ncdc.gov.ng/new/2271.

Mbagwu JPC, Blessing O. Anyian, IW, Omeje FL. The trend of COVID -19 in Nigeria. *Journal of Applied Science Res*, 2020, 16(4), 43-51.

Nwabueze E.U, Onyeka P.I.K, Uduji H. CD4 count and other haematological parameters in HIV/AIDS Patients. *World Journal of Pharmaceutical Science,* 2015, 16: 216-219.

Spencer VM, Paul BK, Joy MC, Kate BC, Browns LK. Impact of Lymphocytopenia among COVID-19 patients in sub-saharan Africa. *International Journal of infectious Diseases*, 2021, 83:1131-1135.

Spent WL. Correlation between diseases severity and inflammation related parameters in patients with COVID-19. *International Journal of Infectious Diseases*, 2020, 84: 106 – 110.

National Health Commission and Administration of Traditional Chinese Medicine: Diagnosis and treatment of patients with Nivel Corona Virus pneumonia 2020. *Chinese Medical Journal*, 133: 1086-1089.

Rizzo, R, Viece, E., Dalla Sega, Fortini F., Morracino C., Rapezzi C., Ferrari, R. Covid-19 in the heart and the lungs: could we "Motch" the inflammation storm? *Basic Res Cardiac*, 2020, 115:31-40.

Wang, B., Li R, Lu, Y. Huong R. (2020). Dresco morbidity increase the risk of patents with covid-19 evidence from meta – analysis. *Aging,* 2020, 12: 6049 – 6057.

Welaram PP and Mayer GC. Mild and severe COVID-19. Laboratory markers. *International Journal of Virology,* 2020, 304-309.

Wenhui Li, Moore Natalya, Vasiolieva, Jianhua Sui, Swee kee W., Michael A. Angiostensin-converting enzyme 2 is a functional receptor for the SARS Coronavirus. *Native,* 2003. 426 (6965). 450-454.

World Health Organization. Laboratory testing for Corona Virus Disease (COVID-19) in suspected human cases. Interim Guidance, 19 March, 2020. Retrieved on July 7, 2020, from http://apps.who/iris/handle/10665/33150.