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Diabetes and hypertension are common comorbidities among Covid-19 patients in Northern Sudan-Atbara

Abstract

Objectives: The current study aims to identify the clinical and pathological characteristics of Sudanese Covid-19 patients who have either diabetes, hypertension, or both.

Method: A retrospective study was carried out in Atbara Isolation Center for Covid-19 patients in River Nile State-Sudan. Data on the clinical and demographic characteristics of 80 Covid-19 patients of various ages and genders who visited the isolation center between December 2021 and February 2022 were gathered from their medical records. Three groups of subjects diabetic, hypertension, and diabetic-hypertensive were created.

Result: The mean age of study group was 66 years old. Severe pathological features of Covid-19 were noticed among all study groups. The percenage of patients with low oxygen saturation was 92.3% of diabetics, 89.7% of hypertensive, and 90.9% of diabetic-hypertensive. Lymphocytopenia was observed in 90.9% of diabetic patients, and 82.6% of hypertensive patients, while all diabetic-hypertensive exhibited low lymphocyte count. A percentage of 23.1%, 28.0%, and 30.8% of diabetic, hypertensive, and diabetic-hypertensive patient had low platelet count, respectively.

Conclusion: We concluded that diabetic, hypertensive and diabetic-hypertensive patient who were affected with Covid-19 were elderly and suffering from severe pathological features of disease, particularly in those who had both diabetes and hypertension. An intensive care is suggested for Covid-19 patients with diabetes, hypertension, as well as those who were affected with two comorbidities.

Keywords: Covid-19, diabetes mellitus, hypertension, Atbara, Sudan

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Introduction

The novel coronavirus [severe acute respiratory syndrome–coronavirus 2 (SARS-CoV-2)] was firstly detected in Wuhan in December 2019[1–3] and then spread over the world, causes Coronavirus Disease 2019 (Covid-19). Covid-19 virus has been identified as a new beta-coronavirus with close relation to SARS-CoV-1 and a number of bat coronaviruses.[4] The Covid-19 virus spreads more rapidly from person to person than SARS-CoV-1 and Middle East respiratory syndrome–coronavirus (MERS-CoV), prompting the World Health Organization to declare a global public health emergency.[1,2] The first Covid-19 patient in Sudan was diagnosed on 12 March 2020, he was a 50-year-old Sudanese male who arrived from United Arab Emirates. He developed respiratory symptoms, was admitted to hospital and died 3 days later with a positive Covid-19 RT-PCR test. Then a wide spread of disease was noticed, however Sudan as one of the poor African countries has a weak health system to manage the pandemic. During Covid-19 pandemic, most Sudanese population do not follow health precaution, refuse the treatment in isolation centers, and depend mainly in herbal treatment in their homes. There for little data is known about disease in Sudan.

The Covid-19 virus nsp12 structure has a right-hand RdRp domain (residues S367 to F920) and a nidovirus-specific N-terminal extension domain (residues D60 to R249) with a NiRAN [5] architecture. An interface domain connects the polymerase domain and the NiRAN domain (residues A250 to R365). An extra N-terminal hairpin (residues D29 to K50) inserts into the groove clamped by the NiRAN domain and the palm subdomain in the RdRp domain, guided by an unambiguous cryo-EM map. The structure of the nsp7-nsp8 pair is comparable to that of the SARS-CoV nsp7-nsp8 pair. [6,7] When compared to the nsp7-nsp8 pair, the orientation of the N-terminal helix of the single nsp8 monomer linked to nsp12 is displaced. The long shaft of nsp8's well-known golf club form is bent, as evidenced by the 13 extra amino acid residues resolved at its N-terminal.

Diabetes may be present in 5.7 % to 5.9% of patients with mild Covid-19, while the frequency of type 2 diabetes mellitus in individuals with severe Covid-19 has increased dramatically from 22.2% to 26.9%. [8,9] These epidemiological findings suggest that diabetes has a crucial role in people with severe Covid-19. TNF and interleukin IL-10[10] have been shown to enhance inflammation when diabetes and hyperglycemia are present. Diabetes can also cause lung problems, such as reduced forced expiratory volume and forced vital capacity.[11] As a result, diabetes may be a risk factor for Covid-19. Hypertension, along with other cardiovascular illnesses, has been linked to an elevated risk of severe Covid-19 and Covid-19 death.[12] People with pre-existing non-communicable diseases, such as hypertension, looked to be more sensitive to developing a severe form of Covid-19, according to a WHO Information Note.[13] Our study aim was to look into the clinical characteristics of people with Covid-19 who have diabetes, hypertension, or both diabetic-hypertensive.

Methods

Study design, subject and area: A retrospective study was carried out in Atbara Isolation Center for Covid-19 patients in Northern Sudan. The study aim was to describe the pathological markers in diabetic, hypertensive, diabetic-hypertensive Sudanese patients with Covid-19. Data was collected from files of patients attended the isolation center in the period of December 2021 to February 2022. A number of 80 Covid-19 patient files were selected to collect the clinical data. Patients were in different ages and of both sexes, they were categorized into diabetic, hypertensive, and diabetic-hypertensive groups. The pathological data including; oxygen saturation, blood pressure, glucose level, and hematological markers were collected.

Statistical analysis: The statistical analysis was done using a statistical software for social sciences (SPSS version 16, Chicago, IL, USA). The mean and standard error of the mean were used to express all numerical data. The proportion of distribution of study participants was calculated using the Chi-square test. To compare the means of variables in the study population, a one sample t test was utilized. The significance level was set at 0.05 with a 95% confidence interval.

Inclusion and exclusion criteria: All diabetic, hypertensive, and diabetic-hypertensive patients with covid-19 who were admitted to the Atbara Isolation Center for Covid-19 for treatment were included in the study. Subjects with covid-19 who had a chronic disease other than the over mentioned in the inclusion criteria or who were disease-free were excluded.

Ethical approval: An ethical approval for the study was obtained from the Ethics Committee, ministry of health.

Results

The study included 80 patients categorized into three groups; diabetic group, hypertensive group, and diabetic-hypertensive group Table 1. The mean age of all patients was 66 years, the ages range was 43-85 years. The mean of oxygen saturation was significantly low in the study population (58.90±0.034) *p* value <0.0001. The mean period of time that patients spend in the isolation center was about 8 days. Systolic blood pressure and diastolic blood pressure means were significantly elevated (125.06±2.856; 77.40±1.668 mmHg) respectively. Random blood glucose level (255.16±0.067mg/dL) was also significantly elevated with p= <0.0001. The mean of TWBCs (10699.37±0.086) was increased, however it was within the upper limit. Lymphocytes and platelet count were (6.17±0.046); (245261.54±0.069) respectively Table 2. The number of females in the current study was 39(49.4%), while the male number was 40(50.6%). The percentage of males 9(64.3%) was high in diabetic patients than females 5(35.7%), however in hypertensive group females 18(58.1%) were more than males 13(41.9%). In diabetic- hypertensive group both genders were equally distributed as shown in Figure 1. The categorization of study groups into different age subgroups revealed that the most prevalent age subgroup was in the range of 61 to 70 years among all study groups as shown in Figure 2. The oxygen saturation in most patient groups was less than 95% (low oxygen sturation), the percenage of patients had low oxygen saturation in these groups was 92.3% in diabetics, 89.7% in hypertensive, and 90.9% in diabetic-hypertensive as displayed in Figure 3.

Table 1 Distribution of study population in study groups

Variables		Number	Diabetic	Hypertension	Diabetic-hypertensive
Age		80	14	32	34
Gender	**Male**	39	9	13	17
	Female	40	5	18	17
Oxygen Saturation %		75	13	29	33
Hypertension		77	14	32	31
Diabetes		50	11	15	24
TWBCs / Cumm		63	12	26	25
Lymphocyte		59	11	23	25
Platelet cells		64	13	25	26

Cumm, cubic millimeter

Table 2 Descriptive data of the study population and mean of study variables

Variables	Minimum	Maximum	Mean ± SE	p-Value
Age/years	43	85	66.00±0.116	<0.0001
Oxygen Saturation %	0	95	58.90±0.034	<0.0001
Duration in isolation\day	1	29	7.96±0.687	<0.0001
SBP (mmHg)	60	200	125.06±2.856	<0.0001
DBP (mmHg)	40	110	77.40±1.668	<0.0001
RBG mg/dL	81	462	255.16±0.067	<0.0001
TWBCs / Cumm	760	21000	10699.37±0.086	<0.0001
Lymphocyte	0.1	38	6.17±0.046	<0.0001
Platelet cells	8000	595000	245261.54±0.069	<0.0001

SE, standard error of mean; P, probability; SBP, systolic blood pressure; DBP, diastolic blood pressure; mmHg, millimeter of mercury; RBG, random blood glucose; mg, milligram, dL, deciliter TWBCs, total white blood cells; Cumm, cubic millimeter

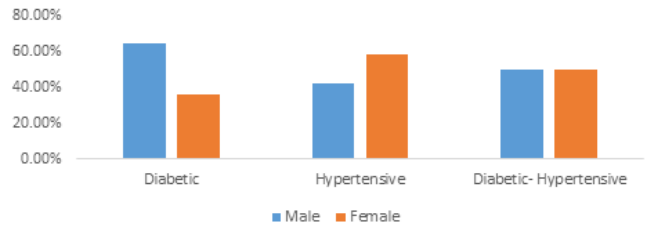

Figure 1 Gender distribution among each study group.

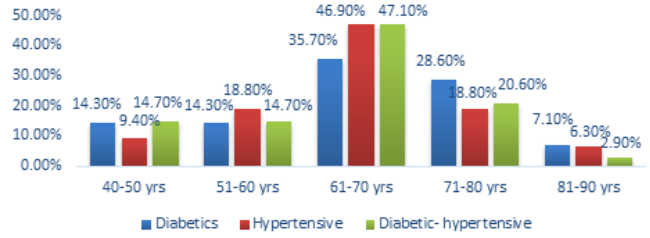

Figure 2 Age subgroups in the study population.

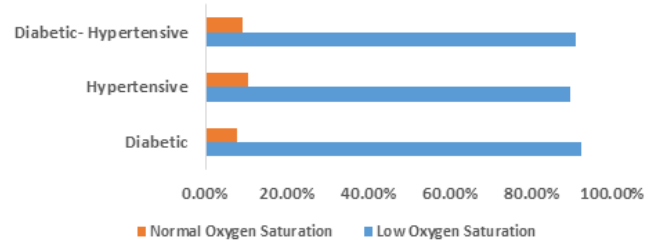

Figure 3 Oxygen saturation in study groups.

Pathological markers

The pathological markers in diabetic, hypertensive, and diabetic-hypertensive groups showed significant difference only in systolic and diastolic pressure. In diabetic patients, the blood pressure was normal in 85.7%, and high in 14.3%, however no one was hypotensive. Regarding the hypertensive patients, most of them were hypertensive 59.4%, whereas 9.4% were low, and 31.3% had normal blood pressure. In diabetic- hypertensive patient distribution was 9.7% had low blood pressure, 25.8% were normal, however the majority of patients were hypertensive with a percent of 64.5.5%. The difference between groups in systolic and diastolic blood pressure was significant with p=0.003. The lymphocyte, platelet, and total white blood cells were not significantly different in the three groups. Lymphocytopenia was observed in the bulk of patients, it was present in 90.9% of diabetic patients, and 82.6% of hypertensive patients, while all diabetic-hypertensive exhibited low lymphocyte count. A percentage of 23.1% of diabetic patient had low platelet count, however 7.7% had high platelet count, the remaining 69.2% were normal. Hypertensive patients with low platelet count were 28.0%, while 8% had high platelet count, and 64.0% were normal. Diabetic-hypertensive had a percent of 30.8%, 65.4%, 3.8% low, normal, and high platelet count, respectively. The percent of those who had high total white blood cells count in diabetic was 33.3%, hypertensive was 42.3%, and diabetic-hypertensive was 60% Table 3. Glucose level was elevated in most patients of diabetic 90.9%, and it was high in 53.3% of hypertensive group. In diabetic -hypertensive patients, the percent of those who had high glucose level was 66.7% Figure 4

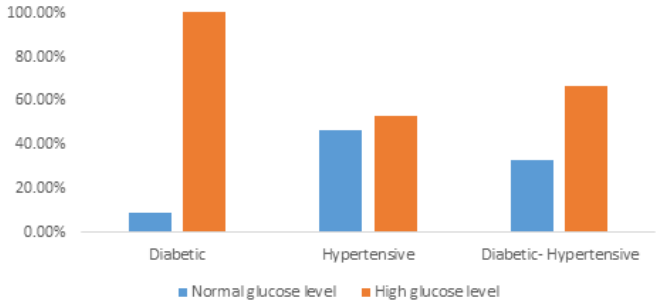

Figure 4 Glucose level among each study group.

Table 3 blood pressure and hematological parameters in diabetic, hypertensive, and diabetic-hypertensive patients with Covid-19

	Diabetic			Hypertensive			Diabetic-Hypertensive			p-Value
	Low	Normal	High	Low	Normal	High	Low	Normal	High	
SBP and DBP (mmHg)	0.00%	85.70%	14.30%	9.40%	31.30%	59.40%	9.70%	25.80%	64.50%	0.003
Lymphocyte %	90.90%	9.10%	0.00%	82.60%	13.00%	4.30%	100.00%	0.00%	0.00%	0.28
Platelet \Cumm	23.10%	69.20%	7.70%	28.00%	64.00%	8.00%	30.80%	65.40%	3.80%	0.96
TWBCs \ Cumm	8.30%	58.30%	33.30%	11.50%	46.20%	42.30%	12.00%	28.00%	60.00%	0.457

mmHg, millimeter of mercury; Cumm, cubic millimeter

Discussion

An increased severity of coronavirus disease 2019 (Covid-19) had been noticed in patients with chronic diseases particularly diabetic, hypertensive or those who have more than one comorbidity. Since the first outbreak of pandemic in Wuhan, elderly people are more prevalent to have the disease.[14] A study in USA reports a percent of 94.4% of Covid-19 were aged 65 years and older and they had at least comorbidity.[15] The most common associated comorbidities found were obesity, hypertension, and diabetes mellitus.[15] In the present study all participated Covid-19 patients were comorbid and the mean age of them was 66 years old similar to,[14] however among individual groups of comorbidities -diabetics, hypertensive, and diabetic hypertensive groups- most of patients ages were 61 - 70 years old. Guan, Liang[16] the mean age of Covid-19 patient with one comorbidity was 58.2 years versus 66.2 years in those with two or more comorbidities. High distribution of Covid-19 was noticed among elderly people since the first outbreak of disease in Wuhan.[17] Severe symptoms and high mortality rates were reported among patients with older ages.[18–20] Patients who old 65 years or older than that are more likely to dead of Covid-19 infection than younger patients [21] although, the high risk of mortality is not related to presence of comorbidity.[22] High incidence of Covid-19 in old people could be explained by decreased clearance of inhaled particles from small airways regions in elderly people, [23] besides reduced ciliary beats and ultrastructure abnormalities in advanced ages.[24] In addition to, the angiotensin converting enzyme

2 (ACE2) expression is increased with age particularly in patients requiring mechanical ventilation.[25] Innate immune system alterations occurs with aging such as changed cytokine response, impaired phagocytosis and altered Toll-like receptor may impact age-related vulnerability to Covid-19. [26]

Our study focused in diabetic, hypertensive and those who were affected with both of diabetes and hypertension and suffering from Covid-19 infection. Some hematological disturbances were reported in the present study such as: lymphocytopenia, low platelets count as well as raised TWBC in all study groups. Regarding lymphocytopenia, our results were in accordance with several previous studies carried on diabetic.[27,28] Lymphocytopenia was noticed majorly in diabetic and hypertensive Covid-19 patients, as well as in patients with both comorbidities and it was strongly correlated to the inflammatory biomarkers of Covid-19.[29] Viral infection is usually associated with a decrease in lymphocyte count and this may be due to direct killing of lymphocytes by the virus, apoptosis of lymphocytes.[30] Lymphocytopenia is clearly associated with Covid-19 severity; patients who have died from disease were significantly had lower lymphocyte counts than survivors, however other hematological markers such as white blood cells, neutrophils, eosinophils, platelets, and CD8 cell counts–were partial predictors in discriminating mild from severe Covid-19.[31] In hypertensive Chinese Covid-19 patients, a retrospective study found a significant decrease in CD4+ and CD8+ T cell count in the early stages of sars-cov2 infection reaches the peak in 1-2 weeks then recovered gradually, but it continues in severe and critical cases of disease.[32]

Limitation of study: This was a retrospective study included a number of 80 Covid-19 patients had diabetes, hypertension or both of comorbidities. A control group of patients without comorbidity was not included to compare the pathological findings. To draw a complete picture about pathological features of Covid-19 in comorbid patients, inflammatory markers such as: interleukins and C-reactive protein should be measured in a future study including a large number of Covid-19 patients.

Conclusion

We concluded that diabetic, hypertensive and diabetic-hypertensive patient who were affected with Covid-19 were elderly and suffering from severe pathological features of disease, particularly in those who had both diabetes and hypertension. An intensive care is suggested for Covid-19 patients with diabetes, hypertension, as well as those who were affected with two comorbidities.

Recommendations

Covid-19 patient with diabetes or hypertension comorbidities should have an intensive health care and management of disease. All comorbid patients particularly those who have diabetes and hypertension should follow up the preventive healthy precaution measurements of Covid-19 as well as having Covid-19 vaccination to avoid severe infection.

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Conflict of Author

The author declares there is no conflict of interest.

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