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*Research Article*

## **Clinico-epidemiological Characteristics of COVID-19 in Patients from Eastern Sudan**

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### **Abstract**

**Background:** Infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has emerged as a profound global health threat. This study aimed to determine the epidemiological and clinical features of COVID-19 among Sudanese patients in the Kassala State, Eastern Sudan.

**Methods:** A retrospective observational study of 90 COVID-19 patients admitted to Kassala Teaching Hospital during Sept 2020 to Jan 2021. Demographic and clinical baseline characteristics of patients were collected using a structured

questionnaire. Nasopharyngeal specimens and blood samples were obtained for confirmatory polymerase chain reaction (PCR) testing of COVID-19 infection.

**Results:** The majority of the patients (75.6%) who were infected with COVID-19 were male. The two most common symptoms on admission were fever (84.4%) and sore throat (58.9%). The most common comorbidity was diabetes mellitus, with a prevalence of 44.4%, followed by chronic pulmonary disease, with a prevalence of 18.9%. Majority of the patients, particularly severe, had lymphocytopenia (95.6%), neutrophilia (88.9%) and leukocytosis (70.0%) (Table 4). High levels of CRP (64.4%) and ESR (63.3%) were observed in the most of study individuals, particularly those with severe conditions.

**Conclusion:** Diabetes and chronic lung disease with inflammation were associated with serious illness among the individuals studied. Other diseases and parameters should be carefully taken into account.

**Keywords:** COVID-19, Clinico-epidemiology, Infections, Kassala, Eastern Sudan

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## **1. Introduction**

The novel coronavirus, called COVID-19, is caused by SARS-CoV-2 infection, SARS-CoV's close relative. It is the third zoonotic human disease caused by coronavirus after severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS) (1,2). In this respect: the first recorded infections with this virus had been at a seafood market in south Wuhan in December 2019 (3,4), and, it turned out, it was simply not possible to rule out human-to-human transmission.

Infection with SARS-CoV-2 can occur in all age groups, with a clinical spectrum that extends from asymptomatic infection to severe disease resulting in hospitalization and death. The early data showed that in a USA 14% of the confirmed cases were hospitalized, 2% were admitted to ICU, and 5% died (5). Hospitalization and death are more prevalent among older (greater than 65 years) patients and those with underlying medical conditions. The latter ones consist of diabetes, cardiovascular disease, chronic pulmonary disease, cancer, kidney disease, liver disease, obesity, sickle cell disease, and other immunodepression diseases (6). The first confirmed cases of COVID-19 in Sudan were identified in March 2020 (7). Despite preventive actions undertaken by the Sudan authorities, the number of cases has been on the rise, with case-fatality rates calculated in the early stages as high as 7.7% based on the number of deaths registered by the end of 2020 (8). As of 11 November 2022, the reported total of Sudanese COVID-19 cases to the World Health Organization is 63,561, with 4980 deaths (9). Due to the sparse data on COVID-19 infection in Sudan, this study was conducted to assess the epidemiological data and clinical features of COVID 19 infected patients in Kassala Teaching Hospital, the main center managing COVID 19 cases, in Kassala State of Eastern Sudan

mainly during the second wave of the pandemic. Considering the scarcity of resources in this area of Sudan, the findings of this study may be useful in formulation of health policies and in guiding preventive strategies and vaccination campaigns to mitigate the threats of the current COVID-19 pandemic.

## **2. Materials and Methods**

### **2.1. Study design and sampling**

This was a retrospective hospital-based study conducted at the COVID-19 isolation center in Kassala Teaching Hospital, Kassala State, Eastern Sudan, from September 2020 to January 2021. All patients included were clinically suspected and confirmed positive for SARS-CoV-2 and consented verbally after registration to participate, totaling ninety patients (n = 90; 68 male and 22 female) enrolled in this study. At admission, the disease diagnosis and severity were assessed, and patients were classified as mild (n = 65), moderate (n = 16), or severe (n = 9) COVID-19 based on World Health Organization (WHO) criteria (10). Patients were excluded if they had stopped therapy or had been discharged before data collection, had received SARS-CoV-2 vaccines, or had received drugs that might alter inflammatory markers. Comprehensive demographic and clinical data were collected by a structured questionnaire in person. COVID-19 positive cases were confirmed by real-time reverse transcriptase-polymerase chain reaction (RT-PCR) of nasopharyngeal swab specimens.

Viral RNA extraction and PCR protocol was performed as per the manufacturer's guidelines<sup>3</sup> (Da An Gene Co., Ltd., China). The peripheral blood samples were collected up to ten milliliters (10 mL) and split into an EDTA anticoagulant container for a complete blood count (CBC) analysis and a vacuum tube without anticoagulants for the assessment of erythrocyte

sedimentation rate (ESR) and C-reactive protein (CRP). The complete blood count (CBC) blood was analyzed using a fully automated hematology analyzer, Sysmex XP-300, Sysmex Corporation, Japan. The complete blood count (CBC) included percentages of leukocytes (WBCs), lymphocytes (LY), and neutrophils (NE).

**2.2. Statistical analysis**

Patient demographic and clinical data were assessed using the Statistical Package for the Social Sciences (SPSS, version 24; IBM Corporation, United States). The analysis used a descriptive statistics, and percentage is used to present categorical variables.

**3.Results:**

Table 1: Demographic and clinical characteristic of patients groups.

	<b>Total (n = 90) n (%)</b>	<b>Severe (n = 9) n (%)</b>	<b>Moderate (n = 16) n (%)</b>	<b>Mild (n = 65) n (%)</b>
<b>Sex</b>				
Male	68 (75.6)	6 (66.7)	10 (62.5)	52 (80.0)
Female	22 (24.4)	3 (33.3)	6 (37.5)	13 (20.0)
<b>Clinical symptoms at admission</b>				
Fever				
Dry cough	76 (84.4)	9 (100)	16 (100)	51 (78.5)
Dyspnea	49 (54.4)	7 (77.8)	13 (81.3)	29 (44.6)
Sore throat	22 (24.4)	9 (100)	13 (81.3)	0 (0)
Headache	53 (58.9)	4 (44.4)	13 (81.3)	36 (55.4)
Myalgia	46 (51.1)	4 (44.4)	11 (68.8)	31 (47.7)
Runny nose	36 (40.0)	4 (44.4)	3 (18.8)	29 (44.6)
	10 (11.1)	1 (11.1)	3 (18.8)	6 (9.2)
<b>Comorbidities</b>				
Diabetes mellitus	40 (44.4)	7 (77.8)	8 (50.0)	25 (38.5)
Hypertension	4 (4.4)	2 (22.2)	2 (12.5)	0 (0)
Renal impairment	3 (3.3)	0 (0)	1 (6.3)	2 (3.1)
Chronic pulmonary disease	17 (18.9)	3 (33.3)	3 (18.8)	11 (16.9)
Neurological disorders	9 (10.0)	0 (0)	2 (12.5)	7 (10.8)

n, number

A total of 90 patients confirmed to be infected with COVID-19 were included in the study, and 75.6% of the patients with COVID-19 were male. The most common symptoms at admission were fever (84.4%),

present in all severe and mild cases, sore throat (58.9%) and dry cough (54.4%). The most common comorbidity, among the study patients, was diabetes mellitus (44.4%), followed by chronic pulmonary disease (18.9%) (table 1).

Table 2. Abnormal serological and hematological parameters frequencies in patients' groups.

<b>Parameters</b>	<b>Total (n = 90) n (%)</b>	<b>Severe (n = 9) n (%)</b>	<b>Moderate (n = 16) n (%)</b>	<b>Mild (n = 65) n (%)</b>
<b>RBC (mmol/L)</b>	13 (14.4)	2 (22.2)	0	11 (16.9)
<b>WBC count (10<sup>3</sup>/μL)</b>	65 (72.2)	9 (100)	9 (56.3)	45 (69.2)
<b>Hb (g/dL)</b>	32 (35.6)	5 (55.6)	2 (12.5)	25 (38.5)
<b>Leukocytosis</b>	63 (70)	9 (100)	9 (56.3)	45 (69.2)
<b>Lymphocytopenia</b>	63 (70.0)	9 (100)	9 (56.3)	45 (69.2)
<b>Neutrophilia</b>	80 (88.9)	9 (100)	13 (81.3)	58 (89.2)
<b>CRP (mg/L; high)</b>	58 (64.4)	8 (88.9)	9 (56.3)	41 (63.1)
<b>ESR (mmHg; high)</b>	57 (63.3)	8 (88.9)	12 (75.0)	37 (56.9)
<b>INR</b>	33 (36.7)	6 (66.7)	6 (38.0)	21 (32.3)
<b>PT (Seconds)</b>	33 (37.0)	6 (67.0)	6 (38.0)	21 (32.3)
<b>PTT (Seconds)</b>	40 (44.4)	7 (6.3)	7 (44.0)	26 (40.0)
<b>PLT count (10<sup>3</sup>/ μL)</b>	1 (1.1)	0 (0)	0 (0)	1 (1.5)

**Abbreviations:** N, number; RBC, red blood cell; WBC, white blood cell; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; INR, international normalized ratio; PTT, partial thromboplastin

time; PT, prothrombin time; Hb, hemoglobin, PLT, platelets.

Immunological parameters such as lymphocytopenia, neutrophilia and leukocytosis were more common in the

study population (Table 2), particularly in patients with severe cases (Table 2). In most of the study participants, especially in severe ones, elevated levels of CRP (64.4%) and ESR (63.3%) were observed.

#### **4. Discussion**

The present study showed that COVID-19 prevalence is higher in males than females. Studies show that males are more susceptible to COVID-19 as indicated by higher rates of infection and higher severity of disease (11,12). However, most of the workforce in our country is occupied by men, which increases with other things such as contact with infected ones, which can give males a higher chance of contacting infected people than females (13,14). There could be several reasons for such disparity and it may not be only limited to gender.

In the current study, admission common signs of patients with severe disease were fever, sore throat, and dry cough. Findings are consistent with prior research showing common COVID-19 symptoms upon admission, namely fever and cough (14,15) in addition to sore throat (8,16), as well as difficulty breathing and fatigue (17,18,19). Fever is a frequent early symptom while dyspnea may indicate respiratory distress, a defining feature of patients with severe COVID-19 (20). Diabetes Mellitus and chronic pulmonary disease have been the most common comorbidity linked with COVID-19 severity, according to this study. That mirrors previous research showing that illnesses like diabetes, hypertension and cardiovascular disease increased the mortality risk among COVID-19 patients. Patients with comorbidities like those with diabetes, hypertension, asthma, and cardiac conditions must take every preventive measure not to become infected by COVID-19 as they may worsen their clinical and survival outcome as more severe (21).

Lymphocytopenia, neutrophilia and leukocytosis were the three main immunological parameters in subjects observed in the current study, and these were correlated with disease severity. Previous studies (19,22) have also shown that severe or critical COVID-19 infections are associated with lymphopenia, which is defined by low lymphocyte counts. Further analysis showed that more than 80% of people who participated had abnormal counts of white blood cells: neutrophils and lymphocytes (23,24) found significant differences in lymphopenia and neutrophilia between people with severe COVID-19 and non-severe COVID-19. The internal components of lymphocytes are then severely damaged by the SARS-CoV-2 virus, leading to lymphocyte death, and this phenomenon is known as lymphocytopenia (3). Participants with severe COVID-19 infections had significantly increased levels of CRP and ESR. However, some elderly COVID-19 patients also showing atypical features, such as lymphopenia, reduced platelet counts, and increased CRP levels (1). Surprisingly, this subgroup of patients had consistent CRP and ESR levels which persisted, leading to a poor prognosis in the long run (15).

The study has some limitations. First, this study has a small sample size, leading to conclusions that only marginally correspond with the literature; more studies require formal approval. Secondly, without funding, the

scope and accuracy of the findings reported is limited. Further studies using a larger sample size and different locations are needed to substantiate these ideas.

#### **Study Limitations:**

1. Retrospective Design: Reliance on existing patient records may result in incomplete or biased data.
2. Small Sample Size: Limited number of patients may affect the generalizability of results.
3. Geographical Focus: Findings may not be representative of other regions or settings.
4. Lack of Control Group: Absence of a control group hinders comparison of outcomes.
5. Confounding Factors: Not all variables that could influence outcomes are accounted for.
6. Data Collection Bias: Inconsistencies in reporting or diagnosis may introduce bias.
7. Short Follow-Up: Limited post-discharge follow-up may miss long-term outcomes.
8. Testing Protocol Variability: Differences in testing protocols could impact diagnosis rates and severity assessments.

#### **Conclusion**

COVID-19 having severe conditions were predominantly presented with comorbidities such as diabetes mellitus and chronic pulmonary disease along with laboratory tests such as lymphopenia, leukocytosis and neutrophilia. As a result, measures to prevent and reduce the impact of the disease are needed.

**Availability** of data and materials. All data are available and can be provided upon request

#### **Competing of interest**

I am declaring that there is no conflict of interest.

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