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Original article

Clinical Characteristics and Outcomes in Diabetic Patients with COVID-19 in Tripoli 2021

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ABSTRACT

Background and aims. *The burden of the Severe Acute Respiratory Syndrome, Coronavirus-2 (SARS-CoV-2), which is also known as COVID-19 has been increasing worldwide, and causes many disabilities and deaths. Diabetes is a major risk factor contributing to the severity of illness and mortality from COVID-19. This study aimed to describe presenting, risk factors, and the clinical characteristics and outcomes of diabetic patients with Coronavirus Disease (COVID-19).* ***Methods.*** *A descriptive case series study was conducted in the Tajuora Rapid response team. Data was collected from patients with a history of diabetes, after taking verbal consent during May and June of 2021. A specific questionnaire was used to collect information including demographic data, diabetes status, comorbidities, clinical symptoms, blood tests, radiographical assessments, and outcomes of COVID-19. SPSS 21 package program was used for statistical analysis.* ***Results.*** *A total of 57 patients with confirmed COVID-19 presentations had diabetes. The majority of these patients are female, 31 (54.4%), and had a mean age (SD) of 64(±11.99) years and a mean duration of diabetes of 1(±6.83) year. Most patients in the study had Type 2 diabetes mellitus (DM), 44 (77.2%), with only 22.8% overall having Type 1 diabetes (n=13). 12.3% of patients displayed evidence of good glycemic control of their diabetes during the 4-12 weeks preceding sickness. 37 patients (64.9%) had other comorbidities including hypertension, ischemic heart disease, dyslipidemia, chronic renal failure, bronchial asthma, and rheumatoid arthritis. 41 patients (71.9%) are treated with insulin. During illness, all patients had a positive PCR result. Most patients, 64.6% (n=37), displayed a positive Chest HRCT scan. 38 patients (66.7%) had positive blood test results. 40 patients (70.2% of patients) were presented with more than three symptoms such as flue like symptoms, dyspnea, productive cough, diarrhea, and vomiting. First Laboratory data of the patients after diagnosis: (Mean ± SD) HBA1C 9.78(±9.93) %, white blood cell 9.38±3.72 (103/µL), lymphopenia 14.12(±10.38) %, D-dimer 3.09 (±9.032) µg/ml, Ferritin 580.31 (±815.75) mg/dl, CRP 81.82 (±92.26) mg/L, urea 42.02(±26.15) mg/dl. 71.9% (n=41) of patients received home management, and 34 (59.5%) needed oxygen therapy at home, 16 patients (28.1%) were transferred to the hospital for deterioration in their condition, and 10(17.5%) of them died due to complications of this diseases. The death rates from COVID-19 infection increase significantly with increasing age of diabetic patients, duration of diabetes- and more in the males.* ***Conclusion.*** *Diabetes is considered a comorbidity as diabetic patients that showed more than three COVID-19 symptoms had critical clinical outcomes such as ICU admission and death*

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INTRODUCTION

The burden of the severe acute respiratory syndrome-Coronavirus-2 (SARS-CoV-2), which is known as COVID-19, has been increasing worldwide. According to the World Health Organization (WHO), COVID-19 was declared as an epidemic on March 11th, 2020 [1]. From January 3, 2020 to 4:32pm CEST on October 15, 2021, there have been 348,647 confirmed cases of COVID-19 with 4,849 deaths in Libya, as reported to WHO. As of October 13, 2021, a total of 1,748,160 vaccine doses have been administered in Libya [2]. Clinical symptoms of COVID-19 include fatigue, fever,

cough, headache, nasal congestion, dyspnea, nausea, and diarrhea [3]. These symptoms could progress into pneumonia and acute respiratory distress syndrome (ARDS) that is accompanied by neutrophilia, lymphopenia, and thrombocytopenia [4-5]. Since COVID-19 is associated with inflammation, it causes an elevation in some markers such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and proinflammatory cytokines [4,6]. Patients with underlying health conditions are considered a high-risk group for catching the novel corona virus. Furthermore, such patients are likely to suffer from severe complication and have an increased risk of death due to COVID-19 [7]. In these patients, the second most frequent comorbidity is diabetes [8].

Certain factors could be contributing to this high-risk observed in diabetes. First, the impairment of the immune system caused by diabetes could be a contributing factor in vulnerability to COVID-19 infection [9]. In addition, the hyperglycemic conditions caused by diabetes increases the susceptibility to infections [10,11]. Furthermore, patients with Diabetes Mellitus (DM) have reduced pulmonary capacity, especially in patients with a poor-control status of the disease and hence, increasing their vulnerability to respiratory infections like COVID-19 [9].

Recently, several studies have suggested that the prevalence of diabetes in patients with a mild case of COVID-19 ranges from 5.7% to 5.9% [12,13], while the prevalence of type 2 diabetes mellitus in patients with severe COVID-19 has seen a sharp rise from 22.2% to 26.9%. These epidemiological evidences indicate a critical role of diabetes in patients with severe COVID-19 [12,13]. There is limited information describing the characteristics and outcomes of diabetic Libyan patients that require hospitalization for coronavirus disease 2019 (COVID-19). Thus, we aim to fill this gap, and to gain insight on the clinical characteristics and outcomes of diabetic Libyan patients with COVID-19.

METHODS

Study setting

A case series study was conducted from May 1 to June 30 of 2021 in the outpatient's department at the Tajuora Rapid response team (special team for corona), and following the patients with COVID 19 by home visit, or phone contact. their center located in Tajuora. COVID filtration center for follow-up of patients with COVID-19. The verbal consent was taken from the new and old diagnostic diabetic patients with confirmed COVID 19 infections, as indicated by the positive result on polymerase chain reaction testing of a nasopharyngeal sample and/or consistent imaging findings on Chest HRCT scan (i.e., pathognomonic changes of ground glass radiological features of COVID-19).

Data collection

Patient data was collected throughout a questionnaire included the following data: sociodemographic and clinical data, medical history of diabetic status, last control state of their diabetes, past medical history, symptom of COVID-19 (such as fever, myalgias, fatigue, anorexia, headache, confusion, rhinorrhea, sore throat, cough, sputum production, hemoptysis, shortness of breath, nausea, vomiting, diarrhea).

Blood tests included complete blood count, lymphocyte count, white cell count (WCC), ferritin, CRP, and D-dimer level, and urea levels. Diagnosis of COVID-19 was done with either positive COVID-19 RT-PCR testing and/or radiographical assessment using chest x-ray and computed tomography (CT) tests. Blood tests for COVID-19 were also performed. Additionally, data was collected regarding whether at-home management was used, whether at-home oxygen therapy was used, the deterioration of clinical status, whether the patient was admitted to the hospital, and the deaths were reported by relatives via telephone.

Statistical analysis

Data was analyzed using SPSS (IBM SPSS Statistics for Windows, Version 21.0). Frequencies and percentage were reported for categorical variables and means with standard deviations (SDs) were reported for continuous variables. The Chi-square test was used for the categorical variables and a P-value <0.05 was considered statistically significant.

RESULTS

A total of 57 patients were included with a mean age of 64.14±11.99 years. 42 (73.7%) of the patients with COVID-19 were in the age group 56-87 years. The number of female subjects that tested positive for COVID-19 was 31 (54.4%), as shown in Table (1).

Table 1. Sociodemographic character (N=57).

Variable	No	%
Age (years) mean age 64.14±11.99 years		
40-55 years	15	26.3%
56-71 years	21	36.8%
72-87	21	36.8%
Gender		
Males	26	45.6
Females	31	54.4
Education level		
Primary	15	26.3
Secondary	20	35.1
University and above	22	38.6

As seen in Table 2, most patients, 44(77.2%), had type 2 diabetes, with a mean duration of diabetes of 11.82±6.83 years and mean of HbA1C 9.78±9.93%. The majority of COVID-19 diabetic patients were treated with insulin therapy, 41(71.9%). Several risk factors are associated with COVID-19 including 6(10.5%) hypertension, 3(5.3%) cardiovascular disease, 3(3.5%) bronchial asthma, 7(12.3%) chronic renal failure, and 2(3.5%) hypothyroidisms. Among these factors, hypertension combined with other disease such as cardiovascular, cerebral vascular accident, rheumatoid arthritis was found to be more present in the diabetic COVID-19 patients 16(28.1%), as shown in Figure 1.

Table (2). Clinical characteristic of the study (N=57).

Variable	No	%
Duration of diabetes mean 11.82±6.83 years		
1-5 years	12	21.1%
6-10 years	13	22.8%
≥11 years	32	56.1%
Type of diabetes		
Type 1	13	22.8%
Type 2	44	77.2%
Treatment of diabetes		
Insulin	41	71.9%
Oral antidiabetic	16	28.1%
HbA1C group		
Controlled	6	10.5%
Uncontrolled	23	40.4%
Unknown	28	49.1%
Comorbidity		
No comorbidity	20	35.1%
Hypertension and others	16	28.1%
Hypertension	10	10.5%
Chronic renal failure	7	12.3%
Heart disease	3	5.3%
Bronchial asthma	3	5.3%

Hypothyroidism	2	3.5%
Symptoms		
Generalized weakness. Fever, headache, myalgia	17	29.4%
All symptoms	40	70.2%
High resolution c.t scan		
Positive	37	64.9%
Negatives	10	17.5%
Not doing	10	17.5%
Home management		
Management at home	51	89.5%
Needed hospital	6	10.5%
Hospitalization		
Yes	16	28.1%
No	41	71.9%
Oxygen therapy		
Yes	34	59.6%
No	23	40.4%
Out come		
Alive	47	82.5%
Died	10	17.5%

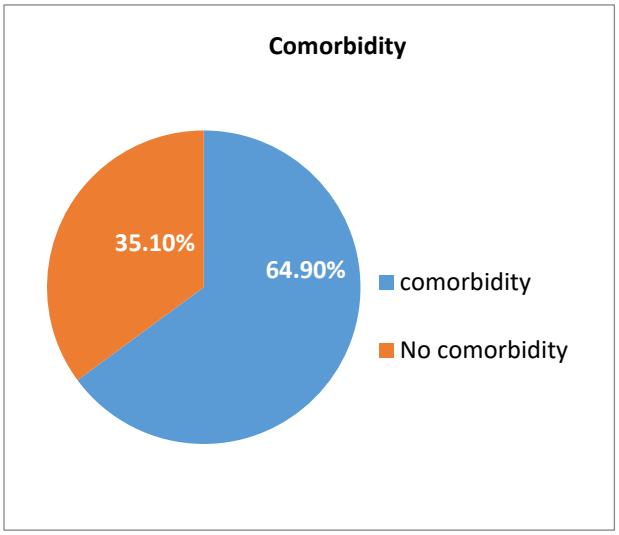

Figure 1. Comorbidity of COVID-19 diabetic patients

Regarding the clinical symptoms associated with COVID-19 diabetic patients, the majority of them presented with all symptoms, 40(70.2%), and only 17(29.8%) patients presented with fever, generalized weakness, headache, and myalgia. When looking at the mean laboratory blood tests, shown in Table (3), results show white blood cell 9.38±3.72 (103/µL), lymphocyte count 14.14±10.38 (103/µL), d-dimer 3.09±9.032 (µg/ml), ferritin 580.3± 815.75 (ng/ml), and urea level 42.0±26.16 mg/dl.

Table 3. Means of biochemical parameter of COVID 19 diabetic patients

Variable	Mean± Standard deviation	Normal range
HbA1c %	9.78±9.93 %	<5.6
White cell count (103/µL)	9.38±3.72	4-11
Lymphopenia n (%)	14.14±10.38	
Urea(mg/dl)	42.0±26.16	
Ferritin (ng/ml)	580.31±815.75	21.81-274.66
CRP (mg/L)	81.82±92.20	0-5
D-dimer (µg/ml)	3.09±4.03	0-0.5

About 57 patients were diagnosed positive for COVID-19 by laboratory RT-PCR test. The main affected organ during the course of COVID-19 infection is the lung. Our data show that 37(64.9%) diabetic COVID-19 patients had confirmed pneumonia on chest HRCT. About 51(89.5%) majority of diabetic COVID-19 patients received their management at home, 34(59.6%) needed oxygen therapy at home, but 16(28.1%) were transferred to the hospital because of deterioration in their health condition and development of acute respiratory distress syndrome. Approximately 47(82.5%) patients had a good outcome for their COVID 19 infection, but 10 patients died due to severe complication of COVID-19 infection (Table 2).

As can be seen in Figure 2, among the 57 diabetic COVID-19 patients, the 10 deaths were within the old-age high-risk group, as the risk of death increases with increasing age, (p=0.058). Gender differences were reported to affect the outcomes of COVID-19 infected individuals, where males have a higher risk of mortality than females, but this is a statically significant relation (p=0.08) (Figure 3). Additionally, more deaths were reported in type 2 diabetes COVID patients than type 1 diabetes COVID patients, (p=0.028) (Figure 4).

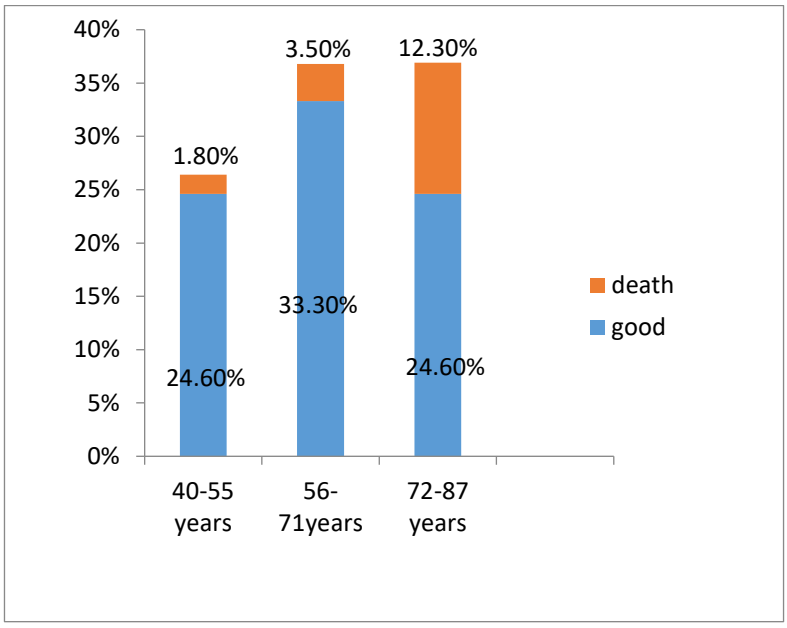

Figure 2. Age by outcome of COVID19 infection

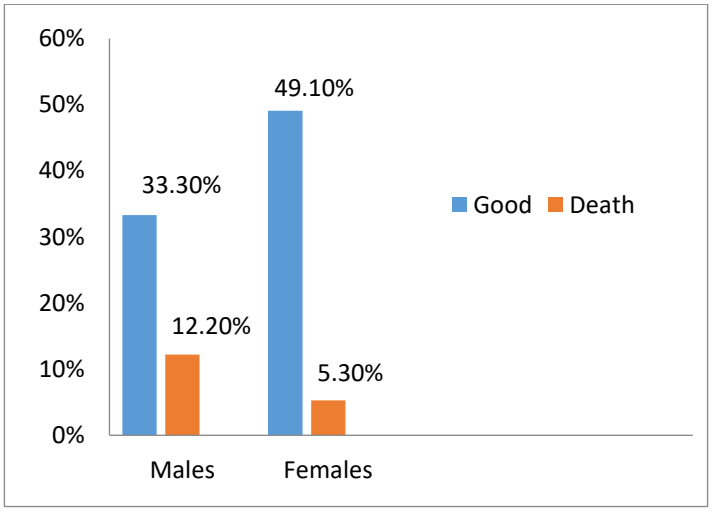

Figure 3. Gender by outcome of COVID-19 infection

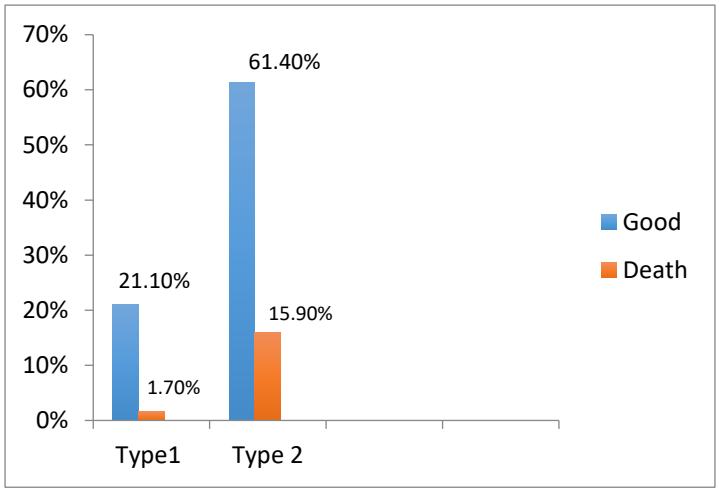

Figure 4. Type of diabetes by outcome COVID-19 infection.

Table 4 presents death rate increasing with an increase in duration of diabetes mellitus (p=0.000). Furthermore, uncontrolled diabetes COVID-19 patients have higher death rates than controlled diabetes COVID-19 patients, showing a statically significant relation (p=0.002).

In regards to symptoms of COVID-19 infection, the patients who presented with all symptoms of COVID-19 showed a higher death rate than the group presented with minor symptoms such as generalized weakness, headache, and fever, indicating the severity of COVID infection (p=0.023).

With regard to associated comorbidity in COVID-19 diabetic patients, our data showed that death rate was higher among those with comorbidity associated with their diabetes, but statically no significant difference was found (p=0.355). The COVID-19 diabetic patients that were first managed at home, and then transferred to hospital as their condition worsened died from acute respiratory complications and other severe complication of COVID-19 infection (p=0.000).

Table 5, presented a comparison of the means of biochemical parameters of COVID-19 diabetic patients show that white blood cell, lymphopenia, high serum ferritin, CRP, and urea level were statistically significantly higher in COVID diabetic patients that died (p=0.000) than those with improved conditions. d-dimer level was also reportedly higher in COVID-19 diabetic patients that died, but a statically significant relation was not found (p=0.135). All these elevated chemical parameters indicate severity of COVID infection and serious complication.

Table (4). Clinical character by outcome of COVID 19 diabetic patients.

Variable	Alive COVID19 patients		Died COVID19 patients	
	No	%	No	%
Duration of Diabetes				
1-5 years	9	15.8%	3	5.3%
6-10 years	12	21.1%	1	1.7%
≥ 11years	26	45.6%	6	10.5%
P value = 0,000				
HbA1C group				
Controlled	4	7	2	3.5%
Uncontrolled	19	33.3%	6	10.5%
Unknown	24	42.1%	2	3.5%
P=0.538				
Associated Comorbidity				
Nocomorbidity	18	31.6%	2	3.5%
comorbidity	29	50.9%	8	14%
P= 0.355				
Symptom of COVID 19				
Minor symptom	17	29.8%	0	0
All symptom	30	52.6%	10	17.5%
Pvalue=0.023				
Home management				
Yes	42	73.7%	9	15.8%
No	5	8.8%	1	1.7%
P value =0.004				
Receiving oxygen therapy at home				
Yes	24	42.1%	10	17.9%
No	23	40.4%	0	0
P value=0.957				
Hospitalization				
Yes	8	14%	8	14%
No	39	68.5%	2	3.5%
Pvalue=0.000				

Table 5. Compare mean of biochemical parameter of out COVID 19 patients

Variable	Alive COVID 19 patients mean±SD	DeathsCOVID19 patients mean±SD	P value
HbA1c %	9.94±10.94	10.01±1.96	0.002
White cell count (103/µL)	8.72±3.30	12.80±4.09	0.000
Lymphopenia n (%)	15.23±10.90	8.58±4.23	0.00
Ferritin (ng/ml)	364.20±451.30	8.58±4.23	0.000
CRP (mg/L)	66.67±87.85	153.05±81.72	0.000
D-dimer (µg/ml)	1.753±4.931	9.41±18.15	0.139
urea(mg/dl)	36.96±21.46	64.79±33.94	0.000

DISCUSSION

This study represents clinical character and outcome of diabetic patients with confirmed COVID-19 infection in Tripoli during 2021. Most of the diabetes patients that attended the Abushusha Polyclinic filter center were females, but males showed a higher risk of death than females. This agrees with emerging studies showing that men with COVID-19 are at higher risk for developing severe outcomes including death than women [14-16]. In addition, diabetic patients belonging to an older age group poses another risk factor that could increase their susceptibility to COVID-19 infection, as presented in this study [17]. The most common associated comorbidities in this were hypertension, cardiovascular disease, and chronic renal failure, as reported in previous studies [18,19]. These make patients more susceptible to COVID-19 infection, a finding that is consistent with the fact that diabetes and cardiovascular disease are key components of the metabolic syndrome [20]. The metabolic syndrome is also associated with pro-inflammatory and pro-thrombotic states which may have important implications for persons affected with COVID-19, where these complications are especially common and troublesome [21]. In the study, diabetic COVID-19 patients presented with profound clinical symptoms that became more severe were supported by receiving oxygen therapy at home. Moreover, high resolution CT scans confirmed that. This result agrees with the previous studies [18,19]. This could be attributed to microvascular damage in diabetes that leads to a complicated alveolar-capillary network in the lungs [22]. This may make COVID-19 more serious in diabetic patients. COVID-19 severity is strongly associated with diabetes [23]. Furthermore, our data indicates that the death rate in diabetic COVID-19 patients increases with increasing age, duration of diabetes, uncontrolled diabetes, and type 2 diabetes, as observed in previous studies [18,19]. The laboratory findings in this study included increased white blood cells, serum ferritin, serum CRP, D-dimer level and lymphopenia in patients with a severe form of COVID-19 infection that led to death from acute respiratory distress syndrome and other complications. This finding agrees with previous studies [18,19].
This study has several limitations. The first limitation was the un cooperation of the patients to complete all investigations leads to lose of some patients. The second and most important limitation was the lack of record files for all the cases.

CONCLUSION

In conclusion, most COVID diabetes were females, of old age, and with type 2 uncontrolled diabetes. Hypertension was the most common comorbidity among them. Most of them showed more severe symptoms that could lead to critical clinical outcomes of COVID-19 infection and cause death. Patients received management at home and some required oxygen therapy. The entire study sample had positive COVID-19 RT-PCR, with pathognomonic changes of COVID-19 detected radiologically. Our laboratory data analysis revealed different abnormal patterns of biomarkers that are associated with poor prognosis. White blood cells, lymphopenia, Fibrinogen, D-dimer, Ferritin and CRP levels were all statistically significantly elevated ($p<0.05$). Majority of the prognosis is alive, with only 16 patients transferred to a hospital after worsening of their condition due to severe acute respiratory distress syndrome and their severe complications, and 10 cases ended in death. Education programme should be done for patients with diabetes (Safe health practices – vaccines). People with diabetes should be reminded that diabetes increases risk of COVID 19 infections, and Tight control of glucose level are important, to keep susceptibility low, and to prevent severity of COVID 19 infection. further studies should be done to have a better reflection about the causes of mortality, and post COVID-19 complication among diabetic patients.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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