Original Article

Demographics, Clinical Characteristics and In-Hospital Outcome of Coronavirus Disease 2019 (COVID-19) Patients With or Without Diabetes Mellitus

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Abstract:

Introduction: Diabetes Mellitus (DM) is one of the important co-morbidity that may negatively influence the clinical outcome of the coronavirus disease 2019 (COVID-19) if it co-exists. There is a paucity of data regarding the characteristics and outcomes of COVID-19 diabetic patients in comparison to non-diabetic patients. Thus, we aimed to compare demographics and clinical characteristics, and in-hospital outcome in COVID-19 positive patients with or without DM.

Method: This prospective observational study included all consecutive confirmed symptomatic and asymptomatic COVID-19 positive patients from March 8th 2020 to July 7th 2023 at the National Heart Foundation Hospital & Research Institute of Bangladesh. Patients were divided into two groups based on whether they had diabetes: Group I- patients with DM and group II- patients without DM. Baseline and clinical characteristics & in-hospital outcome of patients in both groups were assessed for comparison.

Result: This study included a total of 2506 confirmed COVID-19 positive patients. Of them 1003 (40%) patients had DM (Group-I) & 1503 (60%) were without DM (Group-II). Diabetic COVID-19 positive patients were older (56.87 ±11.84 years vs 45.92 ± 16.91 years; p=0.001) and had more co-morbidities (p= 0.001) than patients without DM. Only 4.2% healthcare personnel had DM. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease (90.4% vs 65.7%; p=0.001); hypertension (84.3% vs 41.4%; p=0.001); chronic kidney disease (47.7% vs 29.8%;p=0.001); smoking (37.8% vs 25.9%; p=0.001); dyslipidemia (37.2% vs 17.4%;p=0.001); and chronic obstructive pulmonary disease/bronchial asthma (7.5% vs 4.3%; p=0.001). Most of the patients with DM (G-I) were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in Group-II patients. Diabetic patients had more severe form of COVID-19 disease {(moderate: 3.5% vs 1.4%; p=0.001), (severe: 9.5% vs 4.1%; p=0.001), and (critical ill: 1.3% vs 0.4%; p=0.01)}.Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) and most of the non-diabetic patients were treated either in home isolation or in institutional isolation (70.4% vs 48.0%; p=0.001). COVID-19 patients with DM had worse outcome than patients without DM (mortality rate- 6.1% vs 2.6%; p=0.001).

Conclusion: COVID-19 diabetic patients were usually older, have more comorbidities, a higher probability of hospitalization, increased risk of severe/critical COVID-19 and associated with higher mortality rate as compared with patients without DM.

Key Ward: *COVID-19, demographics, clinical features, DM, in-hospital outcome*

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Introduction:

In the 21st century, within two decades three CoVs of the genera â-CoV, namely severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV), and coronavirus disease 2019 (COVID-19) emerged as significant public health concerns[1]. In November 2002, SARS-CoV was first found in Foshan (China), in April 2012, the first case of MERS-CoV was reported in Jordan[1] and in December 2019, COVID-19 was first reported in Wuhan (China), which became the most dangerous contagious infectious disease of the century and emerged as pandemic. Both hyperglycaemia and a history of type 2 diabetes were independent predictors of mortality and morbidity not only in patients with SARS-Cov[2] but also in patients with MERS-CoV.[3] Emerging data showed that DM was associated with 5.3%-58.0% of patients with COVID-19[4]. COVID-19 patients with newly diagnosed diabetes had the highest risk of all-cause mortality compared with COVID-19 patients with known diabetes, hyperglycaemia and normal glucose[5]. DM as a comorbidity in COVID-19 patients significantly increased the risk of poor outcomes such as COVID-19 disease severity, respiratory failure, ICU admission, longer duration of ventilator dependence, increased length of hospital stay, and mortality compared to those patients without the disease[6]. Evolving data showed that SARS-CoV-2 may lead to direct pancreatic harm, which could aggravate hyperglycemia and potentially cause the establishment of diabetes in formerly non-diabetic individuals[7]. SARS-CoV-2 may cause pleiotropic changes in glucose homeostasis, which could exacerbate the pathophysiology of pre-existing diabetes or result in new disease processes[7]. Coexistence of DM and COVID-19 is an unholy situation where in one disease entity tends to compliment the other[8]. Our main objective was to determine and compare demographics and clinical characteristics, and in-hospital outcome in COVID-19 positive patients with or without DM.

Materials and methods

Study design, setting, and population

This prospective observational study was carried-out in the non-COVID tertiary cardiac care hospital (National Heart Foundation Hospital & Research Institute, Dhaka, Bangladesh) from March 08, 2020 to July 07, 2023. All admitted patients, who subsequently got diagnosed as COVID positive and health care personnel of this hospital, who become COVID positive were included in this study. Both symptomatic and asymptomatic patients were included in this study. The study was approved by the Ethics Review Committee of National Heart Foundation Hospital & Research Institute (N.H.F.H. & R.I./4-14/7/AD-1105) and written informed consent was obtained from all patients or patient's attendance.

Definition and variables

DM was defined as fasting plasma glucose e"126 mg/dL (7.0 mmol/L), 2-h plasma glucose e"200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test, glycosylated hemoglobin A1C e"6.5% (48 mmol/mol), or random plasma glucose e"200 mg/dL (11.1 mmol/L), according to the American Diabetes Association: Standards of Medical Care in Diabetes-2019 [9]. We studied all confirmed symptomatic and asymptomatic COVID-19 patients. Baseline variables, comorbidities, clinical presentation, treatment, and severity of COVID-19 were analysed. Baseline information included gender, age, risk factors and co-morbidities (hypertension, smoking, dyslipidemia, obesity, cardiovascular disease, chronic obstructive pulmonary disease /bronchial asthma (COPD/BA), chronic kidney disease). The degree of severity of COVID-19 were classified as mild, moderate, severe, and critical ill[10,11].

Statistical analysis

Descriptive statistics were used to characterize the study population. Continuous variables are described using the mean and standard deviation (SD), and compared using unpaired student's't' test. Discrete variables were expressed as frequency rates and percentage. Categorical variables between groups were compared using the chi-square test or Fisher's exact test. A p value <0.05 was considered statistically significant. All analyses were performed using SPSS statistical software version 16.0 (SPSS Inc., Chicago, IL, USA).

Results:

During this period a total of 2506 patients were included. Of whom 1003 (40%) patients were in Group-I (with DM) & 1503 (80%) were in Group-II (without DM). The mean age of the patients in Group-I was 56.87 ±11.84 years and in Group-II was 45.92 ± 16.91 years. Male were predominant in both groups (68.8% vs 31.2% and 66.1% vs 33.9%). Only 4.2% healthcare personnel had DM. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease (90.4% vs 65.7%; p=0.001); hypertension (84.3% vs 41.4%; p=0.001); chronic kidney disease (47.7% vs 29.8%;p=0.001); smoking (37.8% vs 25.9%; p=0.001); dyslipidemia (37.2% vs 17.4%;p=0.001); and chronic obstructive pulmonary disease/bronchial asthma (7.5% vs 4.3%; p=0.001). Baseline characteristics of COVID-19 patients with and without DM are presented in Table 1. Most of the patients with DM had multiple comorbidities (Figure 1).

Table-I

Baseline characteristics of patients with COVID-19 with and without DM (n-2506)

Variables	Group-I Diabetes (n=1003) Mean±SD/f(%)	Group-II Non-diabetes (n=1503) Mean±SD/f(%)	P value
Age (Mean±SD) year	56.87 ±11.84	45.92 ± 16.91	0.001#
Gender			
Male	690(68.8%)	(66.1%)	0.16*
Female	313(31.2%)	509(33.9%)	0.16*
Patient category			
HCP	42(4.2%)	409(27.2%)	0.001*
Non-HCP	961(95.8%)	1094(72.8%)	0.001*
Risk factors & comorbidities			
HTN	846(84.3%)	622(41.4%)	0.001*
Smoking	379(37.8%)	390(25.9%)	0.001*
Dyslipidemia	373(37.2%)	262(17.4%)	0.001*
Cardiovascular disease	907(90.4%)	988(65.7%)	0.001*
COPD/BA	75(7.5%)	64(4.3%)	0.001*
Obesity	330(32.9%)	469(31.2%)	0.37*
CKD	478(47.7%)	448(29.8%)	0.001*
Number of comorbidities	0.001*		
<4	539(53.7%)	1208(80.4%)	
≥4	464(46.3%)	295(19.6%)	
Diagnosis	0.001*		
COVID-19 only	92(9.2%)	457(30.4%)	
COVID-19 with heart Disease	911(90.8%)	1046(69.6%)	

COVID-19: coronavirus disease 2019; DM: diabetes mellitus; HCP: healthcare personnel; non-HCP: non-healthcare personnel; SD: standard deviation; HTN: hypertension; COPD: chronic obstructive pulmonary disease; BA: Bronchial asthma; CKD: chronic kidney disease. *Chi square test was done to find out the significance; #Student's 't' test was done to find out the significance.

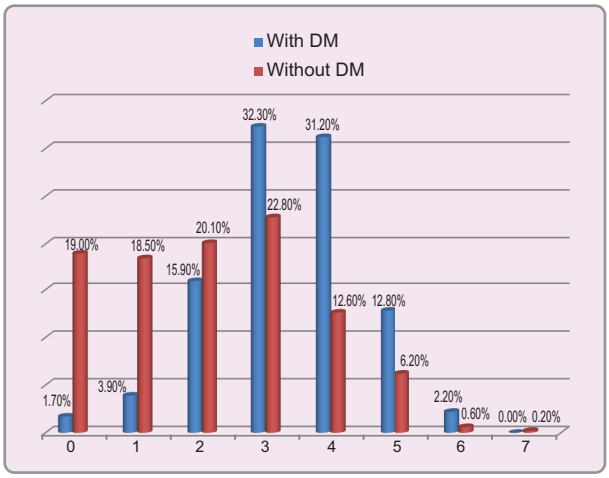

Figure 1: *Bar diagram showing number of comorbidities among patients with COVID-19 positive with (n=1003) or without DM (n=1503)*

COVID-19: coronavirus disease 2019; DM: diabetes mellitus.

Most of the patients with DM (G-I) were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in Group-II patients. Clinical presentations of COVID-19 patients with or without DM are outlined further in Table II.

Patients were treated either in hospital or in isolation. Oxygen therapy (low flow, high flow) was given when required. Prone positioning was advised for all patients. Treatment outline is given in Table 3. Most of the patients with and without DM received ivermectin (381 [38.0%] & 523 [34.8%] respectively). Three patients (0.3%) with DM and one patient (0.1%) without DM received hydroxy-chloroquine. Only 20 (2.0%) patients with DM & 25 (1.7%) patients without DM received favipiravir (1600 mg on day 1 followed by 600 mg 12 hourly from day 2 to day 10).

Remdesivir (200 mg IV infusion [within 30 min-2 hours] on day 1 followed by 100 mg infusion within [30 min to 2 hours] from day 2 to day 5) was required for most of the patients with DM than non-diabetic patients (6.3% vs 3.3%; p=0.001).

Regarding antibiotic therapy, 535 (53.3%) diabetic patients & 723 (48.1%) non-diabetic patients were treated with a single antibiotic and 196 (19.5%) diabetic patients & 162 (10.8%) non-diabetic patients were given double antibiotic therapy (p=0.001).The antibiotics used generally covered common pathogens. The antibiotics used were doxycycline, azythromycin, cephalosporins, fluoroquinolones, carbapenems and â-lactamase inhibitors. Intravenous (IV) antibiotic therapy (39.1% vs 22.0%; p=0.001) and double antibiotics (19.5% vs 10.8%; p=0.001) were given more in patients with DM than without DM. Most of the patients were received either ivermectin plus azithromycin or ivermectin plus doxycycline combination. The duration of antibiotic treatment was 5–10 days. Steroid therapy with methylprednisolone and dexamethasone for 3–7 days was received mostly diabetic patients (7.6% vs 4.1%; p=0.001). Low molecular weight heparin was used in most of the patients with DM than patients without DM (89.2% vs 62.9%; p=0.001) followed by rivaroxaban (10 mg once daily for 1 month). We administered vitamin C, vitamin D_3 and zinc to most of the patients.

Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) and most of the non-diabetic patients were treated either in home isolation or in institutional isolation (70.4% vs 48.0%; p=0.001). In patients with DM-mild disease was 63.2% (634), moderate disease was 3.5% (35); severe disease was 9.5% (95) and critical ill was 1.3% (13). In patients without DM-mild disease was 60.8% (914), moderate disease was 1.4% (21); severe disease was 4.1% (62) and critical ill was 0.4% (6) (Table 4). Patients with DM had higher mortality rate than non-diabetic patients (6.1% vs 2.6%; p=0.18).

Table-II

Clinical presentation of COVID-19 patients with or without DM (n=2506)

Variables	Group-I Patients with DM (n=1003) f(%)	Group-II Patients without DM (n=1503)f(%)	P value*
Clinical presentation			
Symptomatic	777(77.5%)	1003(66.7%)	
Asymptomatic	226(22.5%)	500(33.3%)	0.001
Duration of symptoms	3.46±3.5 days	3.27±4.2 days	0.036
Fever	532(53.0%)	753(50.1%)	0.14
Cough	339(33.8%)	519(34.5%)	0.7
Sore throat	29(2.9%)	180(12.0%)	0.001
Shortness of breath	449(44.8%)	460(30.6%)	0.001
Diarrhea	12(1.2%)	81(5.4%)	0.001
Anosmia	38(3.8%)	160(10.6%)	0.001
Fatigue	272(27.1%)	433(28.8%)	0.35
Headache	88(8.8%)	248(16.5%)	0.001
Bodyache	189(18.8%)	317(21.1%)	0.17
Anorexia	66(6.6%)	111(7.4%)	0.44
Nausea	31(3.1%)	72(4.8%)	0.036
Vomiting	30(3.0%)	73(4.9%)	0.021
Abdominal pain	13(1.3%)	38(2.5%)	0.032
Numbness	20(2.0%)	32(2.1%)	0.816
Dizziness	115(11.5%)	146(9.7%)	0.16
Generalized itching	24(2.4%)	38(2.5%)	0.831

COVID-19: coronavirus disease 2019; DM: diabetes mellitus.*Chi square test was done to find out the significance.

Table-III

Distribution of treatment of patients with COVID-19 with and without DM (n=2506)

Variables	Group-I Patients with DM (n=1003)f (%)	Group-II Patients without DM (n=1503)f (%)	P value*
Antibiotics			
IV	392 (39.1%)	331 (22.0%)	0.001
Oral + IV	64 (6.4%)	43 (2.9%)	
Oral	274(27.3%)	511 (34.0%)	
Not received	273 (27.2%)	618 (41.1%)	
Antibiotics			
Single	535 (53.3%)	723 (48.1%)	0.001
Double	196 (19.5%)	162 (10.8%)	
Not received	272 (27.1%)	618 (41.1%)	
Steroids	76(7.6%)	61(4.1%)	0.001
Favipiravir	20(2.0%)	25 (1,7%)	0.54
Remdesivir	63(6.3%)	49(3.3%)	0.001
Ivermectin	381 (38.0%)	523(34.8%)	0.1
Hydroxy-chloroquine	3(0.3%)	1(0.1%)	0.15
Enoxaparine	895 (89.2%)	945 (62.9%)	0.001
Rivaroxaban	897 (89.45)	956 (63.6%)	0.001

COVID-19: coronavirus disease 2019; DM: diabetes mellitus; IV: intravenous.
*Chi square test was done to find out the significance.

Table-IV

In-Hospital outcome of patients with COVID-19 with and without DM (n=2506)

Variables	Group-I Patients with DM (n=1003)f (%)	Group-II Patients without DM (n=1503)f (%)	P value*
Hospitalization	522 (52.0%)	445 (29.6%)	0.001
Home isolation	481 (48.0%)	1058 (70.4%)	0.001
Disease severity			0.001
Asymptomatic	226(22.5%)	500(33.3%)	0.001
Mild	634(63.2%)	914(60.8%)	0.22
Moderate	35(3.5%)	21(1.4%)	0.001
Severe	95(9.5%)	62(4.1%)	0.001
Critical ill	13(1.3%)	6(0.4%)	0.01
Mortality	61 (6.1%)	39 (2.6%)	0.001

COVID-19: coronavirus disease 2019; DM: diabetes mellitus. *Chi square test was done to find out the significance.

Discussion

Important findings of this study are: 1) Around 40.0% patients had DM; 2) Diabetic patients are usually older and had more comorbidity; 3) Diabetic patients had an increased severity, a higher probability of hospitalization; 4) Diabetic patients with COVID-19 had worse prognosis as compared with non-diabetic patients.

Several mechanisms have been postulated that can contribute to increased susceptibility to COVID-19 infection in diabetic patients[6]: (1) impaired neutrophil recruitment, (2) impaired macrophage activity, (3) impaired interferon gamma production and release from natural killer cells, (4) impairment of antigen presentation resulting in a dysregulated immune response, cytokine

storm and systemic inflammation[12], and (5) increased angiotensin converting enzyme-2 (ACE-2) expression, a surface receptor expressed by epithelial cells of the lung, intestine, kidney and blood vessels causing vasodilation, and hypotension[13].

It was found that hyperglycemia directly enhanced replication of SARSCoV-2, and glycolysis sustains replication of SARS-CoV-2 through the generation of ROS in mitochondria and activation of hypoxia-inducible factor 1á[14]. DM-induced imbalance of the immune response can enhance the chance of dysregulation of immune modulators[4]. Immunological dysregulation in diabetic patients is also considered a risk factor for SARS-CoV-2 infection and is also responsible for disease severity[14,15]. In the context of a preexisting pro-thrombotic hypercoagulable state exacerbated by the presence of DM, hyper-activation of the coagulation cascade in COVID-19 may result in severe thromboembolic outcomes and eventual mortality[16,17].

Emerging data from different countries reported that DM was associated with 5.3%-58.0% of patients with COVID-19 [4]. These variable prevalence rates may be due to inclusion of hospitalized vs non-hospitalized patients, different geographical area, different prevalence rate of COVID-19 and different prevalence rate of DM among study population. A report of the Chinese Center for Disease Control and Prevention (China CDC), which included both hospitalized and non-hospitalized individuals, showed a lower prevalence of diabetes (5.3%) among 44,672 confirmed COVID-19 cases through February 11, 2020[18].COVID-19 patients with DM were more frequently associated with severe or critical disease conditions varying from 14% to 32% in areas[19]. A retrospective study from China showed a 9.7% prevalence of DM, which is equivalent to China's overall diabetes mellitus incidences[5]. A meta-analysis including two studies from US and one study from France reported 11.2% prevalence of DM[20]. Another two single center studies from Italy included hospitalized patients showed 8.9% - 14.9% prevalence of diabetes[21,22]. Prevalence rates were even higher inUS patients hospitalized with COVID-19, ranging from22.6 to 37.2%[23-28]. The nationwide report from the National Institute of Health of Italy showed a diabetes prevalence of 29.8% among 3857 COVID-19 patients (median age 82 years) who deceased through July 9, 2020[29].

In our study, Out of 2506 patients, 40% patients (1003) were diabetic & 60% patients (1503) were non-diabetic. Diabetic patients were older (56.87 ±11.84 years vs 45.92±16.91; p=0.001) than non-diabetic patients. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease; hypertension; chronic kidney disease; smoking; dyslipidemia and chronic obstructive pulmonary disease/bronchial asthma. Most of the patients with DM were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in non-diabetic patients. Diabetic patients had more severe form of COVID-19 disease {(moderate: 3.5% vs 1.4%; p=0.001), (severe: 9.5% vs 4.1%; p=0.001), and (critical ill: 1.3% vs 0.4%; p=0.01)} than non-diabetic patients. Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) COVID-19 patients with DM had worse outcome than patients without DM (mortality rate- 6.1% vs 2.6%; p=0.001).

A nationwide, comparative, retrospective, cohort study included 10,881 hospitalized COVID-19 patients involving 37 hospital sites from around the Philippines[6]. A subgroup analysis was performed comparing the outcomes of patients diagnosed with DM (n = 2191) versus patients without DM (n = 8690). Patients with DM comprised 20.1% of the entire cohort. Diabetic patients were older than non-diabetic patients (median age 61 vs 48 years; p<0.001).More than 50% of the diabetic population were more than 60 years old (n = 1218, 55.6%). Hypertension (74.99% vs 23.06%; p <0.001), smoking (14.6% vs 8.1%; p<0.001)), chronic respiratory disease (13.5% vs 3.6%; p<0.001), and chronic cardiac disease (8.4% vs 4.9%; p<0.0001) were the predominant comorbidities in diabetic than non-diabetic patients. The presence of DM among COVID-19 patients significantly increased the risk respiratory failure, duration of ventilator dependence, severe/ critical COVID-19, ICU admission, and length of hospital stay than non-diabetic patients.Fever, cough, dyspnea, diarrhea and fatigue were observed significantly more in diabetic than non-diabetic patients. Patients with DM had a significantly higher in-hospital mortality rate (26.4% vs 12.9%; $p < 0.001$) compared to those without DM. The adjusted OR for mortality was significantly higher among those in the DM group by 1.46 (95% CI 1.28–1.68; $p < 0.001$)

A retrospective cross-sectional study[30], which was conducted in England included 232 hospitalized COVID-19 patients. Of them 37.5% were having DM. The mean age of the diabetic and non-diabetic patients was 71.4 ± 13.1 years and 69.9 ± 17.1 years, respectively. In diabetic

group, male were predominant (43.4% vs 27.6%) and in non-diabetic group female were predominant (72.4% vs 56.6%). Heart disease was the most common comorbidity in DM patients (77.8%) and hypertension was the most common comorbidity in non-diabetic patients (64.7%). COVID-19 patients with diabetes were more likely to stay longer in hospital than the patients without diabetes (14.4 ± 9.6 days vs 9.8 ± 17.1 days). Patients with diabetic ketoacidosis (DKA) were more likely to survive compared to patients without DKA (87.1% vs 50.6%). In contrast to other studies, this study found no difference in mortalities based on the diabetes status, control or complications. Even mortality rate was higher among non-diabetic patients (55.1% vs 44.9%).

Guo et al.[31] analyzed 174 consecutive patients confirmed with COVID-19 and compared the clinical presentation of COVID-19 between diabetic (with or without comorbidities) and non-diabetic patients. Of them 21.2% patients were diabetic. The median age of the diabetic and non-diabetic patients was 61 {interquartile range (IQR)-55-69} years and 58 (IQR-47-66) years, respectively. In diabetic group, male were predominant (54.1% vs 40.9%) and in non-diabetic group female were predominant (59.1% vs 45.9%). Patients with diabetes had more cardiovascular disease (32.4% vs 14.6%) compared to patients without diabetes. This Chinese study provided some remarkable data. First, in diabetic patients the infection appears to present initially with milder symptoms. Thus, fever was less frequent, which could delay initial diagnosis. Second, more severe pneumonia (more severe pathological changes and higher CT imaging score) were detected by chest CT-scans in patients with DM. Third, diabetic patients (especially those without comorbidity) had more pronounced biological abnormalities, including elevated inflammatory biomarkers [eg. C-reactive protein (CRP), serum ferritin, erythrocyte sedimentation rate (ESR) and interleukin 6 (IL6)], elevated tissue enzymes [eg. lactate dehydrogenase (LDH)], and clotting abnormalities (eg. elevated D-dimer, fibrinogen). The above mentioned abnormalities are related to severe multi-organ damage and to a propensity to thromboembolic events, as well as to the “cytokine storm” described as an aggravating factor of COVID-19 [32]. Fourth, after excluding patients with comorbidities other than diabetes to avoid the impact of other comorbidities on the results showed patients with diabetes were older (61 [IQR, 57-69] vs 32 [IQR, 30-37]), had more nausea and vomiting (16.7% vs 0%) and higher mortality (16.7% vs 0%) compared to patients without diabetes.

Finally, lymphopenia, frequently reported as marker of poor prognosis

[33-35], was more frequent and more severe in diabetic patients. The mortality rate was higher in diabetic patients (10.8% vs 3.6%).

In another two-center retrospective study[36] based in China showed 9.8% (153) patients had DM. One sex- and age-matched COVID-19 patient without diabetes was randomly selected for each patient with diabetes. Five striking observations of this comparative study between diabetic and nondiabetic COVID-19 patients were (1) greater severity of COVID-19 symptoms (e.g., fever, cough, fatigue, and dyspnea) in diabetic patients, (2) increased frequency of other comorbidities in people with diabetes (e.g., hypertension, cardiovascular disease, and cerebrovascular disease), (3) increased necessity of external oxygen supply

in the form of invasive or noninvasive ventilation, (4) a higher proportion of intensive care unit admission (17.6% vs. 7.8%) and more fatal cases (20.3% vs. 10.5%) in diabetic patients, (5) Age ≥70 years and hypertension were independent risk factors for in-hospital death of patients with diabetes.

Limitation

Our study has several limitations. Firstly, study conducted in non-COVID-dedicated cardiac hospital. Secondly, the duration, type of DM, and history of diabetic emergencies were not determined. Thirdly, hemoglobin A1c test was not done for all patients. Fourthly, the diabetic treatment regimen was not evaluated.

Finally, Chest CT was not done for all patients.

Conclusion

COVID-19 diabetic patients were usually older, have more comorbidities, a higher probability of hospitalization, increased risk of severe/critical COVID-19 and associated with higher mortality rate as compared with patients without DM. Therefore, DM might could be considered as a risk factor for the poor outcome of SARS-CoV-2 pneumonia, and in case of rapid deterioration, more intensive attention should be paid to patients with diabetes.

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