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The effect of cardiovascular risk factors on the final outcome in patients with COVID-19

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The effect of cardiovascular risk factors on the final outcome in patients with COVID-19

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Abstract

Background

Increased cardiovascular risk factors are associated with adverse outcome in patients with coronavirus disease-2019 (COVID-19). In this study, the authors assessed the prevalence of cardiovascular risk factors in patients with COVID-19 and studied the impact of these cardiovascular risk factors on the final outcome in these patients.

Aim

The authors aimed to study the prevalence of cardiovascular risk factors in patients with COVID-19 as well as the impact of these cardiovascular risk factors on the final outcome in these patients.

Patients and methods

The study included 200 patients who were admitted in Al-Sahel teaching hospital with COVID- 19-positive PCR. These patients have at least one of these cardiovascular risk factors (hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking).

Results

Bad outcome was associated with the presence of multiple cardiovascular risk factors and the most common cardiovascular risk factors were hypertension and diabetes mellitus. There were 121 hypertensive patients (60.5%), 98 diabetic patients (49.0%), 106 patients were smokers (53.0%), and 54 obese patients (27.0%) and 42 patients (21.0%) had dyslipidemia. In total, 181 patients survived (90.5%), while 19 patients (9.5%) died among patients with COVID-19.

Conclusions

The presence of cardiovascular risk factors, especially hypertension and diabetes mellitus, is associated with bad outcome in patients with COVID-19.

Keywords: COVID, D.M, LDL

Introduction

The cardiovascular risk factors such as hypertension and diabetes mellitus, as well as the chronic cardiovascular diseases, including ischemic heart disease and heart failure, are highly prevalent among patients admitted to hospital with severe coronavirus disease-2019 (COVID-19) [1].

Aim

The work aimed at studying the prevalence of cardiovascular risk factors in patients with COVID-19 as well as the impact of these cardiovascular risk factors on the final outcome in such patients.

Patients and Methods

This study was carried out in Al-Sahel Teaching Hospital during the period from January 2021 to September 2021. In total, 200 patients were enrolled in our study as they

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were admitted with positive polymerase chain reaction for COVID – 19-above 18 years old with one or more of the major cardiovascular risk factors (hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking).

The patients were subjected to the following:
(1) History taking
   (a) Personal history.
   (b) Past history of hypertension, diabetes mellitus, and dyslipidemia.
   (c) Special habits such as smoking.
(2) Physical examination: both general (blood-pressure measurement, heart rate, temperature, and respiratory rate) and local cardiac examination were done for the patients.
(3) Standard 12-lead electrocardiogram (12-lead ECG).
(4) Laboratory evaluation was done for all the patients, including fasting blood sugar, glycated hemoglobin, postprandial blood sugar, renal functions (blood urea and serum creatinine), lipid profile (high-density lipoprotein, low-density lipoprotein, and triglyceride) electrolytes such as NA, K), complete blood count, C-reactive protein, partial thromboplastin time, and international normalized ratio.
(5) Computed tomography: computed tomography of chest study was done for all patients.

RESULTS

The study was conducted on two hundred patients aged 20–79 years (mean age of 44.25 ± 12.67 years). There was male predominance with male-to-female ratio about 1.08: 1, as shown in Table 1.

The majority of the patients (181 patients) (90.5%) were below 60 years' of age and 104 patients (52%) were males (Figs. 1, 2; Table 2).

There were 121 hypertensive patients (60.5%), 98 diabetic patients (49.0%), 106 patients (53.0%) were smokers, 54 obese patients (27.0%), and 42 patients (21.0%) had dyslipidemia (Fig. 3, Table 3).

There were 121 patients (60.5%) who had SO_2 greater than or equal to 90%, while 79 patients (39.5%) had SO_2 less than 90% among patients with COVID-19 (Fig. 4, Table 4).

There were 181 survivors and 19 patients died among patients with COVID-19 (Fig. 5, Table 5).

Table 1: Demographic data distribution among patients with coronavirus disease-2019 ($n=200$)

Demographic data	n (%)
Age (years)	
<60	181 (90.5)
≥60	19 (9.5)
Sex	
Female	96 (48.0)
Male	104 (52.0)

Table 2: Risk-factor distribution among patients with coronavirus disease-2019 ($n=200$)

Risk factors	n (%)
HTN	
No	79 (39.5)
Yes	121 (60.5)
DM	
No	102 (51.0)
Yes	98 (49.0)
Smoking	
No	94 (47.0)
Yes	106 (53.0)
Obesity	
No	146 (73.0)
Yes	54 (27.0)
Dyslipidemia	
No	158 (79.0)
Yes	42 (21.0)

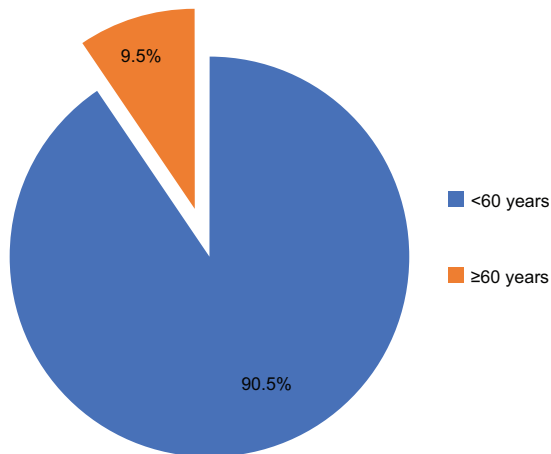DM, diabetes mellitus; HTN, hypertension.

Figure 1: Pie chart showing age distribution among patients with coronavirus disease-2019.
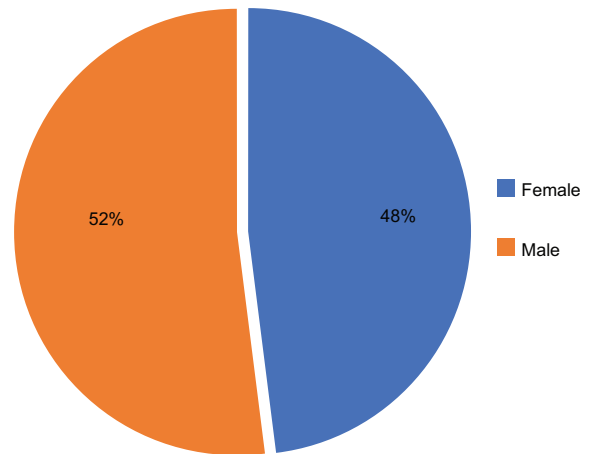

Figure 2: Pie chart showing sex distribution among patients with coronavirus disease-2019.

Only 54 patients (27%) had invasive mechanical ventilation (MV), while 146 patients needed noninvasive modes of ventilation like oxygen mask, nasal cannula, or Continuous positive airway pressure (CPAP) among patients with COVID-19 (Table 6).

There was a high statistically significant association between survival and age with *P* value less than 0.001. Age greater than or equal to 60 years was associated with higher mortality.

While there was no statistically significant association between survival and sex with *P* value of 0.954 (Table 7).

The relation between hypertension and bad outcome was highly significant with *P* value less than 0.001. Hypertension was found in all nonsurvivors (100%) compared with 56.4% of patients of the survivor group.

Also, the relation between bad outcome and the presence of diabetes mellitus was highly significant with *P* value less than

0.001. Diabetes mellitus was found in 100% of patients who died compared with 43.6% of patients of the survivor group.

Furthermore, the relation between bad outcome and the presence of obesity was highly significant with *P* value less than 0.001. Obesity was found in 57.9% of patients who died compared with 23.8% of patients of the survivor group.

Also, the relation between bad outcome and the presence of dyslipidemia was statistically significant with *P* value of 0.003. Dyslipidemia was found in 47.4% of patients who died compared with 18.2% of patients of the survivor group.

Meanwhile, there was no statistically significant association between bad outcome and smoking with *P* value more than 0.05 (NS).

The relation between the presence of hypertension and the use of invasive MV was found to be significant with *P* value of 0.017. Hypertension was found in 74.1% of patients who needed the use of invasive MV compared with 55.5% of patients who did not use invasive MV. This indicates that the presence of hypertension leads to an increase in using invasive MV among patients with COVID-19.

Additionally, the relation between the presence of diabetes mellitus and the use of invasive MV was found to be significant with *P* value of 0.002. Diabetes mellitus was found in 66.7% of patients who needed to use invasive MV compared with 42.5% of the patients who did not use invasive MV. This indicates that the presence of diabetes mellitus leads to an increase in using invasive MV among patients with COVID-19.

Furthermore, the relation between the presence of obesity and the use of invasive MV was found to be significant with *P* value of 0.003. Obesity was found in 42.6% of patients who needed to use invasive MV compared with 21.2% of patients who did not use invasive MV. This indicates that the increased BMI leads to an increase in using of invasive MV among patients with COVID-19.

Table 3: Oxygen saturation less than 90% distribution among patients with coronavirus disease-2019 (*n*=200)

SO$_2$<90	*n* (%)
No	121 (60.5)
Yes	79 (39.5)
Total	200 (100.0)

Table 4: Survival outcome distribution among patients with coronavirus disease-2019 (*n*=200)

Survival	*n* (%)
Survivors	181 (90.5)
Nonsurvivors	19 (9.5)
Total	200 (100.0)

Table 5: Invasive mechanical ventilation (MV) distribution among patients with coronavirus disease-2019 (*n*=200)

Invasive MV	*n* (%)
Noninvasive MV	146 (73.0)
Invasive MV	54 (27.0)
Total	200 (100.0)

Table 6: The relation between outcome and age and sex of the patients

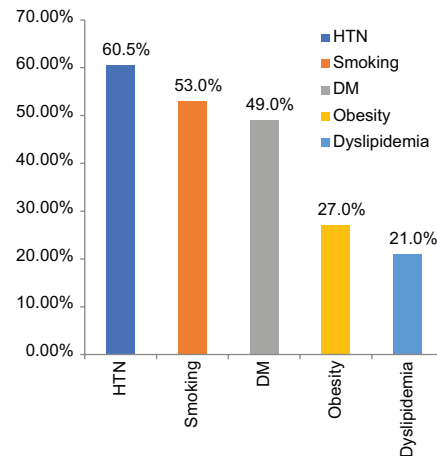| Demographic data	Outcome [*n* (%)]		Total [*n* (%)]	*P*
	Survivor (*n*=181)	Nonsurvivor (*n*=19)		
Age (years)				
<60	179 (98.9)	2 (10.5)	181 (90.5)	<0.001
≥60	2 (1.1)	17 (89.5)	19 (9.5)	
Sex				
Female	87 (48.1)	9 (47.4)	96 (48.0)	0.954
Male	94 (51.9)	10 (52.6)	104 (52.0)	

Figure 3: Risk-factor distribution among patients with coronavirus disease-2019.
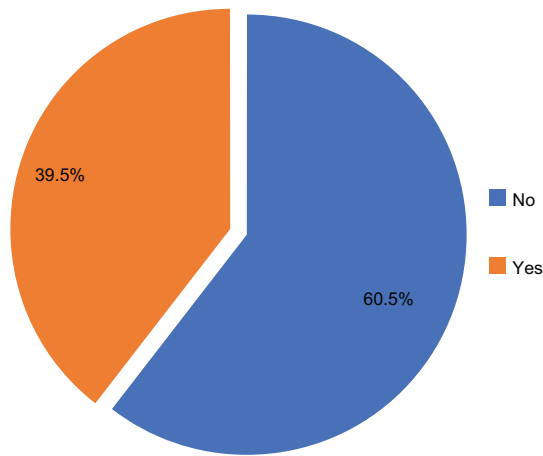
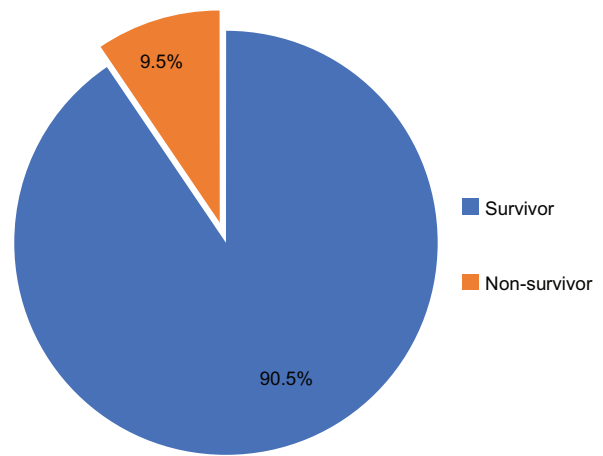**Figure 4:** Oxygen saturation less than 90% distribution among patients with coronavirus disease-2019.

Figure 5: Survival outcome distribution among patients with coronavirus disease-2019.

Table 7: The relation between outcome and the risk factors

Risk factors	Outcome [n (%)]		Total [n (%)]	P
	Survivor (n=181)	Nonsurvivor (n=19)		
HTN				
No	79 (43.6)	0	79 (39.5)	<0.001**
Yes	102 (56.4)	19 (100.0)	121 (60.5)	
DM				
No	102 (56.4)	0	102 (51.0)	<0.001**
Yes	79 (43.6)	19 (100.0)	98 (49.0)	
Smoking				
No	85 (47.0)	9 (47.4)	94 (47.0)	0.973
Yes	96 (53.0)	10 (52.6)	106 (53.0)	
Obesity				
No	138 (76.2)	8 (42.1)	146 (73.0)	<0.001**
Yes	43 (23.8)	11 (57.9)	54 (27.0)	
Dyslipidemia				
No	148 (81.8)	10 (52.6	158 (79.0)	0.003*
Yes	33 (18.2)	9 (47.4)	42 (21.0)	

DM, diabetes mellitus; HTN, hypertension. P >0.05 (NS).
*P <0.05 (Significance). **P <0.001 (Highly significance).

The relation between the presence of dyslipidemia and the use of invasive MV was found to be highly significant with P value less than 0.001. Dyslipidemia was found in 37% of patients who needed to use invasive MV compared with 15.1% of patients who did not use invasive MV. This indicates that the presence of dyslipidemia leads to an increase in using invasive MV among patients with COVID-19.

There was no statistically significant association between using invasive MV and smoking with P value greater than 0.05 (NS) (Table 8).

Ethical considerations
A written informed consent was taken from all patients and approval of the CMREC (Cairo Medical Research Ethics Committee).

DISCUSSION
Our study was conducted on 200 COVID-19 patients to study the prevalence of cardiovascular risk factors in patients with COVID-19 and the impact of these risk factors on their final outcome. The study was done on male and female patients above 18 years old admitted with positive polymerase chain reaction for COVID-19 and with at least one of the major cardiovascular risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking in Al-Sahel teaching hospital.

Regarding risk factors, in our study, there were 121 hypertensive patients (60.5%), 98 diabetic patients (49.0%), 106 patients (53.0%) were smokers, 54 obese patients (27.0%), and 42 patients (21.0%) had dyslipidemia. This was in agreement with Song *et al.* [2] and Gerotziafas *et al.* [3].

Song *et al.* [2] reported that the most common cardiovascular risk factors reported in patients with COVID-19 before hospital admission were hypertension (56.4%) and diabetes mellitus as regards to long-term home medications.

Regarding the final outcome, in our study, there were 181 patients (90.5%) who survived and 19 patients (9.5%) died among patients with COVID-19. This was in agreement with Nicholson *et al.* [4]

Nicholson and colleagues reported that, among the 1042 patients admitted to the hospital, only 210 patients died in hospital (20.2%), while 832 patients (79.8%) were discharged. They stated that 86% of the patients who died had at least one comorbidity [4].

In our study, there were 146 patients (73%) who used noninvasive modes of assisted ventilation and 54 patients (27%) who used invasive MV. This was in agreement with Nicholson *et al.* [4].

Nicholson *et al.* [4] reported that 404 patients out of 449 (90.0%) admitted to the intensive care with COVID-19, were mechanically ventilated, while 45 patients (10.0%) used noninvasive modes of assisted ventilation.

Table 8: The relation between the use of invasive mechanical ventilation (MV) and the risk factors

Risk factors	Invasive MV [n (%)]		Total [n (%)]	P
	Noninvasive MV (n=146)	Invasive MV (n=54)		
HTN				
No	65 (44.5)	14 (25.9)	79 (39.5)	0.017*
Yes	81 (55.5)	40 (74.1)	121 (60.5)	
DM				
No	84 (57.5)	18 (33.3)	102 (51.0)	0.002*
Yes	62 (42.5)	36 (66.7)	98 (49.0)	
Smoking				
No	73 (50.0)	21 (38.9)	94 (47.0)	0.162
Yes	73 (50.0)	33 (61.1)	106 (53.0)	
Obesity				
No	115 (78.8)	31 (57.4)	146 (73.0)	0.003*
Yes	31 (21.2)	23 (42.6)	54 (27.0)	
Dyslipidemia				
No	124 (84.9)	34 (63.0)	158 (79.0)	<0.001**
Yes	22 (15.1)	20 (37.0)	42 (21.0)	

DM, diabetes mellitus; HTN, hypertension.

In our study, there was a highly statistically significant relation between outcome and age 'years' with P value less than 0.001. The higher age greater than or equal to 60 years was significantly more in nonsurvivor group (89.5%) compared with survivor group (1.1%). This was in agreement with Silverio *et al.* [5], Kunihiro *et al.* [6], Collard *et al.* [7], and Pareek *et al.* [8], who also reported in their studies the presence of a high significant relation between age and hospital mortality.

Regarding the relation between bad outcome and the presence of risk factors, we found in our study that the relation between mortality and the presence of hypertension is highly significant with P value less than 0.001. This was in agreement with Di Castelnuovo *et al.* [9] and Kunihiro *et al.* [6].

Di Castelnuovo *et al.* reported that mortality was more in hypertensive patients hospitalized for COVID-19 [9].

Kunihiro *et al.* [6] reported that all eligible studies with data on hypertension reported a positive correlation between hypertension and severe COVID-19.

Additionally, we found in our study that the relation between mortality and the presence of diabetes mellitus is highly significant with P value less than 0.001. This was in agreement with Di Castelnuovo *et al.* [1,7,8] and Collard *et al.* [7].

Di Castelnuovo *et al.* [9] reported that diabetes mellitus is associated with a higher risk of mortality in hospitalized COVID-19 patients.

Furthermore, we found in our study that the relation between mortality and the presence of obesity is highly significant with P value less than 0.001. This was in agreement with Jewbali *et al.* [10] and Di Castelnuovo *et al.* [9], who found a positive correlation between obesity and in-hospital mortality.

In our study, the relation between outcome and dyslipidemia was found to be significant with P value of 0.003. This was in agreement with Collard *et al.* [7] and Kunihiro *et al.* [6].

Collard and colleagues reported that the presence of hypertension and dyslipidemia among patients with COVID-19 predisposes for adverse outcomes.

Regarding the association between using invasive MV and risk factors, in our study, the relation between using invasive MV and the presence of hypertension was found to be highly significant with P value of 0.017. This was in agreement with Nicholson *et al.* [4].

Additionally, in our study, the relation between using invasive MV and the presence of diabetes mellitus was found to be highly significant with P value of 0.002. This was in agreement with Nicholson *et al.* [4].

Conclusion

(1) Our study was carried out on PCR-positive patients for COVID-19 where there were 121 hypertensive patients (60.5%), 98 diabetic patients (49.0%), 106 patients were smokers (53.0%), 54 obese patients (27.0%), and 42 patients (21.0%) had dyslipidemia.

(2) In total, 181 patients (90.5%) survived, while 19 patients (9.5%) died among patients with COVID-19.

Conflicts of interest

There are no conflicts of interest.

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