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The Impact of Covid-19 on Patients with Co-morbidity Diseases: Experience and Challenging against COVID-19 Pandemic

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Abstract

Objective: The aim of this study was to evaluate the risk of serious adverse outcomes in patients with diabetes, hypertension, Chronic Obstructive Pulmonary Disease (COPD) and coronary heart disease (CHD) related Covid-19 by stratifying the comorbidity status. **Subjects and methods:** This is a cross-sectional study based on 1,117 male and female aged 25-75 years old patients and 816 (73%) patients gave consent to participate. Demographics, clinical biochemistry and microbiology information, the presence of disease and comorbidities were analyzed. We performed descriptive and multivariate regression analyses. **Results:** There was a significant difference between males versus females with respect to age groups, BMI, smoking cigarette, alcohol use, co-morbidity, thyroid, COPD, infection, stroke, CHD, hypertension, diabetic and cerebral. Significant differences were reported between gender, hemoglobin, HbA1C, fasting blood glucose (mmol/L), vitamin D (mmol/L), calcium (mmol/L), albumin (mg/dL), Creatinine (mg/dL), HDL (mmol/L), LDL (mmol/L), Ferritin (mmol/L), Fe (mmol/L), and systolic (mm Hg) and diastolic Bp (mm Hg), respectively. Further, significant differences were reported between gender including: White blood cell (/mm^3), vitamin D (mmol/L), Creatine kinase -CK (ug/L), Creatine kinase myocardial band CK-MB (ug/L), D-dimer (ug/L), Hematocrit (ug/L), , neutrophil (/mm^3), lymphocyte (/mm^3), creatinine (mg/dL), CRP (mg/L), procalcitonin (ug/L), vitamin D, metabolic syndrome (ATP III) and metabolic syndrome (IDF)), respectively. The multivariate stepwise regr+ession analysis indicated that hypertension ($p<0.001$), stroke ($p<0.001$), systolic blood pressure ($p<0.001$), CHD ($p<0.001$), COPD ($p<0.001$), CK-MB ($p=0.019$), infection ($p=0.036$), diabetic ($p=0.037$), creatine kinase ($p=0.044$) were considered as risk predictors of the co-morbid among COVID-19 patients. **Conclusion:** The present study indicated that over one-third of the population have co-morbid symptoms during the COVID-19 outbreak. This study determined that hypertension, CHD, stroke, COPD, infection and diabetes were the most prevalent co-morbidities disease among COVID-19 patients.

Keywords: Epidemiology; COVID-19; Comorbidity; Coronary heart diseases; Diabetes; Hypertension; COPD

Introduction

Several studies reported that diabetes, hypertension, cardiovascular diseases, coronary heart disease (CHD) and chronic obstructive pulmonary disease are the most prevalent among COVID-19 patients [1-6]. The situation is worsening rapidly with increasing case counts and deaths worldwide [7]. Li et al [6] founded the high prevalence of hypertension, CHD, cerebrovascular disease and diabetes among COVID-19 patients.

The clinical occurrence and distribution of Covid-19 are varied from place to place according latest reports [7-8].

Generally, at the admission, 20-51% of patients reported as having at least one comorbidity, with diabetes (10-20%), hypertension (10-15%) and other cardiovascular and cerebrovascular diseases (7-40%) [5,9-11]. The risk factor of comorbidity of hypertension and cardiovascular disorder is 30.7%, and 11.9% with diabetes mellitus [12-13]. Chronic Obstructive Pulmonary Disease (COPD) [14-15] and CHD significantly associated with COVID-19 related hospital admission and death [16-19]. In this study, we are aiming to evaluate the risk and prevalence of patients with coronary heart disease, diabetes, hypertension, and COPD among coronavirus disease (Covid-19) patients by stratifying the comorbidity status in Turkey.

Subjects and Methods

This prospective cohort study conducted on the patients screened and diagnosed with COVID-19 at Istanbul Medipol University based on several Medipol Hospitals and Research Hospitals. The study included Accident Emergency Department, Departments of Internal Medicine, Endocrinology, Cardiology and Infectious Diseases, Clinical Biochemistry and Microbiology between periods from January to August 2021. The study included age, gender, presence of hypertension, T2DM, coronary heart disease (CHD), congestive heart failure, stroke, chronic obstructive pulmonary disease (COPD). The study protocol was approved by the Istanbul Medipol University and Faculty of Medicine Institutional Review Board (IRB) Ethics Research Committee. (Research Protocol and IRB #E-10840098-772.02-1411).

This is a cross-sectional design study conducted among residential population of Istanbul. The sample size was based on previous prevalence reported (30% to 35%) of co-morbid [5, 9, 16] among visited patients as sample proportion likely to be considered 30%, assuming 99% confidence interval with 3% error of estimation sample size needed to be 1,117 subjects and 816 (73%) male and female and aged 25-75 years agreed and gave consent to participate in this research during January to August 2021.

Socio-demographic data, clinical biochemistry and microbiology, the presence of co-morbid symptoms and signs, treatment, and outcomes were collected and evaluated by consultant team of physicians. RT-PCR results of nasopharynx and throat samples were analyzed by Medipol Hospitals COVID-19 diagnosis laboratory which was authorized and assessed by the Ministry of Health. The routine blood sample investigation and influenza polymerase chain reaction testing was also performed for all patients. A chest radiograph determined clinically by health care consultants.

The significance differences between two independent groups the Student's t-test was conducted. Chi-square analysis was performed to test for differences in proportions of categorical variables between two or more groups. Multivariate stepwise regression analysis method was used to predict risk factors for the co-morbid. The level $p<0.05$ was considered as the cut-off value for significance.

Results

Table 1 shows socio-demographic characteristics of subjects COVID-19 by gender. There was a significant difference between males versus females with respect to age groups, BMI, smoking cigarette, nargile use, co-morbidity, thyroid, COPD, infection, stroke, CHD, hypertension, diabetic and cerebral.

Variables		Male= 447	Female= 459	*p*-Value
		n (%)	n (%)	Significance
Age group	<50	141 (31.5)	111 (24.2)	
	50-59	89 (19.9)	93 (20.3)	
	60-69	87 (19.5)	80 (17.4)	0.015
	=>70	130 (29.1)	175 (38.1)	
BMI	Normal (<25 kg/m^2)	88 (19.7)	131 (28.5)	
	Overweight (29-30 kg/m$^{2)}$	2115 (47.2)	190 (41.4)	0.008
	Obese (>30 kg/m^2)	148 (33.1)	138 (30.1)	
Smoking cigarette	Yes	88 (19.7)	58 (12.6)	0.014
	No	359 (80.3)	401 (87.4)	
Nargile-Sheesha water pipe	Yes	84 (18.8)	59 (12.9)	0.014
	No	363 (81.2)	400 (87.1)	
Co-Morbidity	Yes	139 (31.1)	112 (24.4)	0.015
	No	308 (68.9)	347 75.6)	
Thyroid	Yes	73 (16. 3)	113 (24.6)	0.002
	No	374 (83.7)	346 (75.4)	
Chronic Obstructive Pulmonary Disease (COPD)	Yes	142 (31.8)	112(31.1)	0.014
	No	305 (68.2)	347 (71.2)	
Infection	Yes	98 (21.9)	132 (28.8)	0.018
	No	349 (78.1)	327 (71.2)	
Stroke	Yes	92 (20.6)	120 (27.9)	0.010
	No	355 (79.4)	304 (72.1)	
Coronary Heart Disease (CHD)	Yes	144 (32.2)	116 (23.3)	0.021
	No	303 (67.8)	343 (76.7)	
Hypertension	Yes	136 (30.4)	107 (23.3)	0.016
	No	352 (69.6)	352 (68.4)	
Diabetes	Yes	83 (18.6)	113 (24.6)	0.027
	No	364 (81.4)	346 (75.4)	
Cerebrovascular Disease (CVD)	Yes	49(11.0)	78 (17.0)	0.009
	No	398 (89.0)	381 (83.0)	

Table 1: Socio-demographic characteristics of subjects about COVID-19 positive by Gender (N = 906).

Variables	Males = 447 Mean ± SD	Females = 459 Mean ± SD	P value
BMI kg/m^2	28.17 ± 4.26	27.68 ± 4.49	0.041
Hemoglobin (g/dL)	11.45 ± 2.71	11.00 ± 2.37	0.004
HbA1c	6.01 ± 1.04	5.83 ± 1.29	0.002
Fasting Blood Glucose (mmol/L)	120.83 ± 64.08	134.95 ± 84.31	0.003
Vitamin D (mmol/L)	18.80 ± 7.34	17.68 ± 7.65	0.026
Vitamin B12	273.15 ± 41.09	277.70 ± 37.13	0.705
Calcium (mmol/L)	8.51 ± 0.87	8.63 ± 0.80	0.026
Urea (mg/dL)	48.09 ± 5.11	46.05 ± 4.26	0.605
Phosphor (mmol/L)	3.62 ± 1.30	3.69 ± 1.00	0.375
Creatinine (mg/dL)	73.12 ± 30.59	77.70 ± 28.42	0.018
Albumin (mg/dL)	3.43 ± 0.61	3.55 ± 0.55	0.045
Cholesterol (mmol/L)	170.81 ± 56.97	177.09 ± 52.77	0.099
HDL (mmol/L)	36.38 ± 12.16	38.11 ± 11.03	0.008
LDL (mmol/L)	180.42 ± 46.80	176.04 ± 56.59	0.131
Triglyceride (mmol/L)	154.22 ± 0.72	162.36 ± 53.91	0.392
Uric Acid (mmol/L)	6.08 ± 2.22	6.10 ± 3.64	0.424
Ferritin (ug/L)	372.92 ± 46.31	269.54 ± 58.84	0.008
Fe (ug/L)	61.32 ± 12.65	55.96 ± 10.97	0.001
TSH	1.69 ± 1.10	1.70 ± 1.05	0.952
Systolic Blood Pressure mm Hg	132.64 ± 10.66	134.29 ± 10.26	0.016
Diastolic Blood Pressure mm Hg	77.87±6.69	78.86 ± 6.20	0.021

Table 2. Clinical biochemistry data values by gender among COVID-19 positive patients (N= 906).

Variables	Males = 447 Mean ± SD	Females = 459 Mean ± SD	p value
Creatine kinase (ug/L)	41.50 ± 20.87	35.15 ± 22.27	0.020
Creatine kinase-myocardial band; (ug/L)	15.79 ± 11.45	13.51 ± 8.92	0.049
D-dimer (ug/L)	7.99 ± 0.80	7.48 ± 0.88	0.001
Hematocrit (ug/L)	36.51 ± 6.55	37.93 ± 6.47	0.022
White blood cell (/mm^3)	7932.5 ± 1303.0	7296.3 ± 1605.0	0.001
Neutrophil (/mm^3)	5.95 ± 3.45	6.61 ± 3.98	0.008
Lymphocyte (/mm^3)	1.60 ± 0.89	1.78 ± 0.98	0.004
Platelet (103/mm^3)	228.71 ± 107.8	217.17 ± 94.1	0.086
Aspartate transaminase (U/L)	28.22 ± 10.42	26.21 ± 10.41	0.183
Alanine transaminase (U/L)	23.11 ± 3.28	20.74 ± 6.02	0.074
C-reactive protein (mg/L)	24.86 ± 3.93	20.17 ± 5.11	0.002
Procalcitonin (ug/L)	0.23 ± 0.10	0.25 ± 0.10	0.001
Vitamin D	**n (%)**	**n (%)**	
Deficiency <20 ng/ml	249 (55.7)	300 (65.4)	
Insufficiency 20 -29 ng/ml	150 (33.6)	108 (23.5)	0.003
Sufficiency>30 ng/ml	48 (10.7)	51(11.1)	
Metabolic Syndrome (ATP III)			
Yes	141 (31.5)	110 (24.0)	0.011
No	306 (68.5)	349 (76.0)	
Metabolic Syndrome (IDF)			
Yes	160 (35.8)	129 (28.1)	0.013
No	287 (64.2)	330 (71.9)	

Table 3: Clinical biochemistry baseline value by gender among COVID-19 positive patients (N=906).

Variables	Regression coefficient	Standard Error	Standardized Coefficients Beta	t-test value	p-value significance
Hypertension	0.525	0.022	0.522	24.030	0.001
Stroke	0.639	0.023	0.613	28.672	0.001
Systolic Blood Pressure	0.400	0.101	0.391	4.3823	0.001
Coronary Heart Disease (CHD)	-0.146	0.022	-0.147	-6.796	0.001
Chronic Obstructive Pulmonary Disease (COPD)	0.079	0.018	0.079	4.286	0.001
Creatine kinase myocardial band (CK-MB)	-0.122	0.052	-0.112	-2.348	0.019
Infection	0.072	0.034	0.070	2.097	0.036
Diabetic	-0.198	0.095	-0.198	-2.085	0.037
Creatine kinase	0.056	0.028	0.055	2.015	0.044

Table 4: The relationship and risk predictors of the co-morbid among COVID-19 patients using multivariate stepwise regression analysis (N=906).

Table 2 reports the baseline values of biochemical indices by gender among COVID-19 patients. Significant differences were reported between gender, hemoglobin, HbA1C, fasting blood glucose (mmol/L), vitamin D (mmol/L), calcium (mmol/L), albumin (mg/dL), Creatinine (mg/dL), HDL (mmol/L), Ferritin (mmol/L), Fe (mmol/L), and systolic (mm Hg) and diastolic Bp (mm Hg), respectively.

Table 3 gives the clinical biochemical values by gender among COVID-19 patients. Significant differences were reported between gender including: CK, CK-MB, hematocrit, WBC, Vitamin D (mmol/L CK (ug/L), CK-MB (ug/L), D-dimer (ug/L), Hematocrit (ug/L), White blood cell (/mm^3), Neutrophil (/mm^3), Lymphocyte (/mm^3), Creatinine (mg/dL), CRP (mg/L), Procalcitonin (ug/L), vitamin D, Metabolic Syndrome (ATP III) and Metabolic Syndrome (IDF)), respectively.

Table 4 presents the relationships between hypertension, diabetes, COPD, and coronary heart disease among the patients with COVID-19 using multivariate stepwise regression analysis method. The multivariate stepwise regression analysis indicated that hypertension ($p<0.001$), stroke ($p<0.001$), systolic blood pressure ($p<0.001$), CHD ($p<0.001$), COPD ($p<0.001$), Creatine kinase myocardial band ($p= 0.019$), infection ($p=0.036$), diabetic ($p=0.037$), creatine kinase ($p= 0.044$) were considered as risk predictors of the co-morbid among COVID-19 patients after adjusting for age and gender.

Discussion

The current study revealed co-morbid of COPD (31.8%), stroke (20.6%), CHF (32.2%), hypertension (30.4%), diabetes (18.6%) and cerebrovascular disease (11%). Also, the prevalence of co-morbid among patients with COVID-19 studies has been observed and reported vary differently; ranged from 25% to 35% [5, 9, 16] this is consistent with our results. Several studies have reported COVID-19 patients that increased age as risk with clinical severity such as coronary heart disease, hypertension, cardiovascular diseases, diabetes, and chronic obstructive pulmonary disease in patients with COVID-19 [3-6,16,20-21]. Those results are confirmative with current study outcome.

Recently some studies [20-24] reported that coronary heart failure, diabetes, hypertension, cardiovascular disease, were more common among COVID-19 patients who died in comparison with survivors. The current study based on a large population with effect of comorbidities.

More recently, some authors findings indicated that hypertension is one of the commonest and highest occur as comorbidities in patients with COVID-19 [22-24]. This is consistent with the current obtained results. Meanwhile, unfortunately, the size of morbidity and mortality rate of COVID-19 patients in Turkey is alarming according to the WHO situation report [2,7-8].

In the view of public health pandemic, the role of a clinical public health is not only being as an academic leader to formulate work guidance and re-commendations, but also as a clinical practitioner of health services, providing medical care and advice to frontline medical staff and ensuring the rational prevention during the pandemic. At the same time, we found that the epidemic has driven the development of innovative and remote health services.

The current study has several limitations. Firstly, this is a cross-sectional design, which may not describe cause-effect relation. Second, the study may not reach to the target patient as considered bias. Third, the clinical investigation and assessment used for the co-morbidity in relation to COVID-19 may not be accurate; therefore the results must be interpreted with caution.

Conclusion

The present study indicated that over one-third of the population have co-morbid symptoms during the COVID-19 outbreak. This study determined that hypertension, CHD, stroke, COPD, infection and diabetes were the most prevalent co-morbidities disease among COVID-19 patients.

Ethics Committee Approval: The authors would like to thank the Istanbul Medipol University for their support and the Clinical Research Ethics Committee of Istanbul Medipol University, Institutional Review Board (Research Protocol and IRB# 10840098-604.01.01-E.14180).

Peer-review

Externally peer-reviewed.

Contributors

AB, AN, contributed to conception, design, organized study, collected data, performed statistical analysis and wrote the first draft of the article, and contributed to the to the interpretation of the data and writing, revised critically and approved final version of manuscript.

ZN, MA, and KI are organized study, collected data, wrote the first draft of the article, and contributed to the interpretation of the data and writing, revised critically and approved final version of manuscript. All authors approved the final version.

Conflict of Interest

No conflict of interest was declared by the authors.

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