Predictors of clinical decompensation in patients presenting with COVID-19 in an urban hospital health system

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Funding Acknowledgement: Type of funding sources: Public hospital(s). Main funding source(s): Loyola University Medical Center

Introduction: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in a pandemic which has infected more than 128 million people and led to over 2.8 million deaths worldwide. Although the introduction of efficacious vaccines has led to overall declines in the incidence of SARS-CoV-2 infection, there has been a recent increase in infections once more due to the appearance of mutant strains with higher virulence. It therefore remains vital to identify predictors of poor outcomes in this patient population.

Purpose: The objective of our study was to identify predictors of prolonged hospitalization, intensive care unit (ICU) admission, intubation, and death in patients infected with SARS-CoV-2.

Methods: We conducted a retrospective analysis of all patients hospitalized with SARS-CoV-2 at our health system that includes one tertiary care center and two community hospitals located in the Chicago metropolitan area. The main outcome was a composite endpoint of hospitalization >28 days, ICU admission, intubation, and death.

Explanatory variables associated with the primary outcome in the bivariate analysis ($p<0.05$) were included in the multivariable logistic regression model. Statistical analysis was performed using IBM SPSS 25.0.

Results: Between March 1, 2020 and May 31, 2020, 1029 patients hospitalized with SARS-CoV-2 were included in our analysis. Of these patients, 379 met the composite endpoint. Baseline demographics are described in Table 1. Of note, our cohort consisted of a predominantly minority patient population including 47% Hispanic, 17% African American, 16% Caucasian, and 16% other.

In bivariate analysis, age, hypertension, tobacco and alcohol abuse, obesity, coronary artery disease, arrhythmias, valvular heart disease, dyslipidemia, hypertension, stroke, diabetes, documented thrombosis, troponin, CRP, ESR, ferritin, LDH, BNP, D-dimer >5x the upper limit of normal, lactate, and right ventricular outflow tract velocity time integral <9.5 were significant.

After multivariable adjustment, explanatory variables associated with the composite endpoint included troponin (OR 2.36; 95% CI 1.08–5.17, p 0.03), D-dimer (OR 1.5; 95% CI 1.23–1.98, $p<0.01$, lactate (OR 1.58; 95% CI 1.28–1.95, $p<0.01$), and documented thrombosis (OR 3.56; 95% CI 1.30–8.70, $p<.05$). Race was not a predictor of poor outcomes in the bivariate or multivariate analysis (Table 2).

Conclusions: In a large urban cohort with a predominantly minority population, we identified several clinical predictors of poor outcomes. Of note, race was not a predictor of the primary endpoint in this study. While recent literature has demonstrated worse outcomes among racial minorities infected with SARS-CoV-2, our data suggests these variations are related to social determinants of health rather than biologic causes.

Table 1. Baseline Demographics

	Patients not meeting primary outcome* (n=650)	Patients meeting primary outcome* (n=379)
Age (years, SD)	59.1 (17)	63.3 (17)
Female (n, %)	284 (43.8)	160 (42.2)
Body mass index (SD)	30.9 (8.5)	31.4 (10.0)
Coronary artery disease (%, SD)	74 (11.4)	60 (15.8)
Congestive heart failure (%, SD)	58 (8.9)	45 (11.9)
Hypertension (n, %)	342 (52.7)	245 (64.6)
Diabetes mellitus, type 2 (n, %)	240 (37)	177 (46.7)

*Primary outcome: composite of death, hospitalization >28 days, ICU admission, and need for intubation.

Table 2. Clinical Variables

Variable	Unadjusted Odds Ratio (95% CI)	P value	Adjusted Odds Ratio (95% CI)	P value
Age	1.0 (1.0-1.02)	0.01		
Hypertension	1.6 (1.25-2.1)	<0.01		
Alcohol abuse	1.2 (1.01-1.38)	0.04		
Tobacco abuse	1.2 (1.02-1.41)	0.29		
Coronary artery disease	1.6 (1.07-2.24)	0.02		
Arrhythmia	1.6 (1.20 – 3.00)	0.01		
Valvular Heart Disease	2.5 (1.14-5.54)	0.02		
Dyslipidemia	1.8 (1.35-2.33)	<0.01		
Stroke	2.1 (1.33-3.37)	0.01		
Diabetes mellitus type 2	1.5 (1.16-1.94)	0.02		
Venous thromboembolism	5.8 (2.8 -10.03)	<0.01	3.6 (1.30-8.70)	<0.05
Troponin	4.2 (2.1.0-8.26)	<0.01	2.4 (1.08-5.17)	0.03
CRP	1.0 (1.0-1.1)	<0.01		
ESR	1.0 (1.0-1.02)	0.01		
Ferritin	1.0 (1.0-1.01)	<0.01		
LDH	1.0 (1.0-1.01)	<0.01		
BNP	1.0 (1.0-1.01)	0.05		
D-Dimer >5x ULN	8.5 (6.1 – 11.9)	<0.01	1.5 (1.23-1.98)	<0.01
Lactate	1.8 (1.53-2.15)	<0.01	1.6 (1.28-1.95)	<0.01
Right ventricular outflow tract velocity time integral <9.5 cm	1.0 (1.0-1.01)	0.03		