



Clinical Outcomes of Critically Ill Patients with COVID-19 by Race

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Abstract

Background Studies of COVID-19 have shown that African Americans have been affected by the virus at a higher rate compared to other races. This cohort study investigated comorbidities and clinical outcomes by race among COVID-19 patients admitted to the intensive care unit.

Methods This is a case series of critically ill patients admitted with COVID-19 to an academic healthcare system in Atlanta, Georgia. The study included all critically ill hospitalized patients between March 6, 2020, and May 5, 2020. Clinical outcomes during hospitalization included mechanical ventilation, renal replacement therapy, and mortality stratified by race.

Results Of 288 patients included (mean age, 63 ± 16 years; 45% female), 210 (73%) were African American. African Americans had significantly higher rates of comorbidities compared to other races, including hypertension (80% vs 59%, $P = 0.001$), diabetes (49% vs 34%, $P = 0.026$), and mean BMI (33 kg/m² vs 28 kg/m², $P < 0.001$). Despite African Americans requiring continuous renal replacement therapy during hospitalization at higher rates than other races (27% vs 13%, $P = 0.011$), rates of intubation, intensive care unit length of stay, and overall mortality (30% vs 24%, $P = 0.307$) were similar.

Conclusion This racially diverse series of critically ill COVID-19 patients shows that despite higher rates of comorbidities at hospital admission in African Americans compared with other races, there was no significant difference in mortality.

Keywords COVID-19 · Mortality · Race · African American · Outcomes

Introduction

The coronavirus disease 2019 (COVID-19) has led to death tolls surpassing 2,000,000 people globally and 395,000 people in the USA [1, 2]. Studies to date have shown that COVID-19 infects African Americans (AA) at a higher rate compared with other major races in the USA; the Centers for Disease Control and Prevention (CDC) has found that AA have a 178.1/100,000 rate of COVID-19, second to only Native Americans and Native Alaskans (221.2/100,000) and significantly higher than that of white Americans (40.1/100,000) [3–6]. The racial disparity seen with COVID-19 rates has been associated with differences in household size, social distancing, community education, and ability to work from home which some communities of color do not have [7, 8]. These social issues and healthcare disparities have been apparent in the past but have been further amplified by COVID-19 [7, 9]. In addition to social factors, studies have also shown that AA have high frequencies of hypertension, diabetes, chronic kidney disease, and obesity, factors associated with poor outcomes from COVID-19 [10–13].

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There are limited data assessing racial differences in clinical outcomes of critically ill COVID-19 patients. Cohort studies in Louisiana and Georgia found that race was not associated with hospital mortality after adjusting for differences in sociodemographic and clinical characteristics [6, 14]. The objective of our study was to evaluate whether racial differences impact the frequency of in-hospital complications and overall mortality of critically ill patients in a racially diverse cohort.

Methods

This observational cohort study includes data from hospitalized COVID-19 patients admitted from March 6, 2020, to May 5, 2020, who were admitted to Emory Healthcare, an academic healthcare system in Atlanta, Georgia. Patients 18 years or older that were hospitalized in the ICU were eligible for inclusion once positive COVID-19 status was confirmed based on a severe acute respiratory syndrome coronavirus 2 polymerase chain reaction assay. Other COVID-19-positive patients who did not reach ICU level of care needs were excluded. Patient data was obtained from the electronic medical record (EMR) (Cerner Millennium EMR, Kansas City, MO, USA) using proprietary data collection software internally developed on the Oracle Apex platform (Redwood City, CA, USA). Categorical and continuous data elements were automatically extracted using an internally validated technique from the Cerner Millennium EMR through the Apex platform. Data elements contained in free text were manually abstracted by members of the Emory COVID-19 Quality and Clinical Research Collaborative (QCRC) and entered into the Apex platform [15]. The variables that were

investigated included data on demographics, medical comorbidities, hospitalization, and outcomes. For analysis, data from the Apex environment were merged with data directly extracted from the Millennium platform to create a comprehensive dataset of all investigated variables.

Data were collected through June 9, 2020, and analyzed using a chi-square or independent sample *t* tests for categorical and continuous variables, respectively, with a two-sided *P* value of less than 0.05 considered statistically significant. Univariate analysis and multivariate analysis were done on all categorical and continuous variables on the outcome of mortality. Significance for univariate analysis was set at a *P* value of less than 0.1 and for multivariate analysis significance was set at a *P* value of less than 0.05. All statistical analysis was SPSS version 25 (IBM Corporation, Armonk, New York). This study was approved by the Emory University Institutional Review Board.

Results

During the study period, 288 patients were admitted to the ICU with a diagnosis of COVID-19. The mean age was 63 (\pm 16) years, 131 (45%) were female, 209 (73%) were AA, 68 (24%) were white, 10 (3.4%) were Asian, and 1 (0.3%) was multiple race. Compared with non-AA, AAs had significantly higher rates of hypertension (80% vs 59%, *P* = 0.001) and diabetes (49% vs 34%, *P* = 0.026) and a higher mean BMI (33 vs 28, *P* < 0.001) (Table 1). There were no differences between races in history of coronary artery disease, stroke, chronic kidney disease, chronic obstructive pulmonary disease, asthma, obstructive sleep apnea, HIV, or other immunocompromised state.

Table 1 Comorbidities in ICU hospitalized patients by race

Admission characteristics	Total (<i>n</i> =288)	AA (<i>n</i> =209)	Other (<i>n</i> =79)	<i>P</i> value
Age, SD	63 (16)	62 (15)	65 (18)	0.269
Female, <i>n</i> (%)	131 (45)	95 (45)	36 (46)	0.986
HTN, <i>n</i> (%)	214 (74)	167 (80)	47 (59)	<0.001
DM, <i>n</i> (%)	129 (45)	102 (49)	27 (34)	0.026
BMI (<i>n</i> =285), mean (SD)	32 (8)	33 (9)	28 (6)	<0.001
CAD, <i>n</i> (%)	40 (14)	25 (12)	15 (19)	0.124
Stroke, <i>n</i> (%)	39 (14)	26 (12)	13 (16)	0.374
CKD, <i>n</i> (%)	43 (15)	34 (16)	9 (11)	0.300
COPD, <i>n</i> (%)	19 (7)	12 (6)	7 (9)	0.341
Asthma, <i>n</i> (%)	28 (10)	17 (8)	11 (14)	0.139
OSA, <i>n</i> (%)	24 (8)	18 (9)	6 (8)	0.780
HIV, <i>n</i> (%)	5 (2)	5 (2)	0 (0)	0.328
Other immunocompromised state, <i>n</i> (%)	11 (4)	7 (3)	4 (5)	0.501

HTN hypertension, DM diabetes mellitus, BMI body mass index, CAD coronary artery disease, CKD chronic kidney disease, COPD chronic obstructive pulmonary disease, OSA obstructive sleep apnea, HIV human immunodeficiency virus

Table 2 Clinical outcomes in ICU patients by race

Hospitalization data and outcome	Total (n=288)	AA (n=209)	Other (n=79)	P value
Hospitalization duration, mean days (SD)	18 (12)	18 (12)	19 (12)	0.700
ICU length, mean days (SD)	11 (9)	10 (8)	11 (9)	0.330
Intubated, n (%)	212 (74)	155 (74)	57 (72)	0.730
Intubation length, mean days (SD)	11 (8)	11 (8)	11 (9)	0.952
CRRT, n (%)	66 (23)	56 (27)	10 (13)	0.011
CRRT length, mean days (SD)	9 (6)	9 (6)	9 (7)	0.937
HD, n (%)	39 (14)	32 (15)	7 (9)	0.153
HD length, mean days (SD)	7 (5)	7 (5)	6 (6)	0.727
SOFA, mean (SD)	6 (4)	6 (4)	7 (4)	0.215
Death, n (%)	82 (29)	63 (30)	19 (24)	0.307

ICU intensive care unit, CRRT continuous renal replacement therapies, HD hemodialysis, SOFA sequential organ failure assessment

Mean hospital length of stay was 18 (± 12) days, and ICU length of stay was 11 (± 9) days. Overall, 212 (74%) patients were intubated for a mean of 11 (± 8) days; 66 (23%) patients required continuous renal replacement therapy (CRRT) for a mean of 9 (± 6) days. There were 82 (29%) patients who died. There was no significant difference in length of stay, intubation rates, length of intubation, and deaths between AAs and non-AA patients (Table 2). CRRT was more frequently required in AA patients (27% vs 13%, *P* = 0.011), whereas intermittent hemodialysis rates were similar (15% vs 9%, *P* = 0.153).

In univariable analysis, factors associated with in-hospital mortality included age (OR: 1.058, 95% CI: 1.036–1.080, *P* value: < 0.001), hypertension (OR: 1.793, 95% CI: 0.949–3.387, *P* value: 0.072), coronary artery disease (OR: 2.081, 95% CI: 1.046–4.140, *P* value: 0.037), hospital length of stay (LOS) (OR: 0.918, 95% CI: 0.888–0.948, *P* value: < 0.001), ICU LOS (OR: 0.872, 95% CI: 0.941–1.004, *P* value: 0.087), intubation rate (OR: 2.091, 95% CI: 1.094–3.997, *P* value: 0.026), CRRT use (OR: 4.591, 95% CI: 2.563–8.226, *P* value: < 0.001), and BMI (OR: 0.909, 95% CI: 0.871–0.949, *P* value: < 0.001), but not race (Table 3). In multivariable analysis,

Table 3 Variables associated with inpatient mortality in univariate analysis

Variable	Odds ratio	95% confidence interval	P value
Age	1.058	1.036–1.080	<0.001
Female	0.914	0.546–1.530	0.733
African American	1.363	0.752–2.469	0.308
HTN	1.793	0.949–3.387	0.072
DM	1.169	0.700–1.953	0.551
BMI	0.909	0.871–0.949	<0.001
CAD	2.081	1.046–4.140	0.037
Stroke	1.491	0.732–3.035	0.271
CKD	1.607	0.814–3.172	0.171
COPD	1.509	0.572–3.978	0.406
Asthma	0.517	0.189–1.409	0.197
OSA	0.477	0.158–1.441	0.189
HIV	3.873	0.635–23.620	0.142
Other immunocompromised state	0.547	0.116–2.589	0.447
Hospitalization duration	0.918	0.888–0.948	<0.001
ICU length of stay	0.972	0.941–1.004	0.087
Intubated	2.091	1.094–3.997	0.026
CRRT	4.591	2.563–8.226	<0.001
HD	0.985	0.465–2.085	0.968
SOFA	1.042	0.975–1.112	0.224

Table 4 Multivariable analysis of variables associated with in-hospital mortality

Variable	Odds ratio	95% confidence interval	P value
Age	1.094	1.056–1.134	<0.001
BMI	0.886	0.825–0.951	0.001
HTN	0.859	0.309–2.391	0.771
CAD	2.486	0.907–6.811	0.077
Hospital duration	0.760	0.697–0.828	<0.001
ICU length of stay	1.148	1.044–1.262	0.004
Intubation	4.824	1.545–15.062	0.007
CRRT	20.806	6.874–62.981	<0.001

BMI body mass index, *HTN* hypertension, *CAD* coronary artery disease, *ICU* intensive care unit, *CRRT* continuous renal replacement therapies

age (OR: 1.094, 95% CI: 1.056–1.134, *P* value: <0.001), hospital duration (OR: 0.760, 95% CI: 0.697–0.828, *P* value: <0.001), ICU length of stay (OR: 1.148, 95% CI: 1.044–1.262, *P* value: 0.004), intubation rate (OR: 4.824, 95% CI: 1.545–15.062, *P* value: 0.007), CRRT use (OR: 20.806, 95% CI: 6.874–62.981, *P* value: <0.001), and BMI (OR: 0.886, 95% CI: 0.825–0.951, *P* value: 0.001) were associated with in-hospital mortality (Table 4).

Discussion

In our racially diverse cohort of critically ill COVID-19 patients including 73% AAs, we found that intubation rate and in-hospital mortality were similar between AA and non-AA patients. This was found despite AAs having higher rates of comorbidities including hypertension, diabetes, and obesity compared to non-AAs. AAs did have higher rates of CRRT than non-AAs despite having similar rates of chronic kidney disease history on admission. The prevalence of these comorbidities observed in AA vs non-AA has been reported previously and increases the complication rates in patients infected with COVID-19 [10–13, 16, 17]. These results are similar to those of a cohort study in Louisiana, which found similar in-hospital mortality rates between AAs and non-AAs despite AAs having higher rates of acute renal failure [6]. In another cohort study from Georgia which included ICU and non-ICU patients, AA patients were found to have similar rates of invasive mechanical ventilation and death compared to non-AA patients [13].

Though COVID-19 proved to be challenging to all hospital systems, Atlanta did not observe the overwhelming case numbers early in the pandemic as some other major cities [1]. Our study was limited to metropolitan Atlanta hospitals within one academic health system in Georgia and may have limited generalizability to other healthcare settings. However, our study

represents a large cohort of critically ill COVID-19 patients including a large proportion of AA patients. Additionally, this study is limited by being a retrospective analysis of an ICU-specific cohort that does not compare mortality rates outside of an ICU setting. Despite these limitations, our study shows similar in-hospital mortality rates between AAs and other races despite AAs having higher rates of comorbidities at admission and higher rates of RRT in the hospital. Whether these findings are due to pre-hospital social factors [4], differences in the disease manifestation or differences in provider treatments require further study.

Conclusion

Despite critically ill AA with COVID-19 presenting with higher rates of comorbidities compared to other races, rates of intubation and mortality were similar at an academic healthcare system in Atlanta, Georgia. Our findings show that in a healthcare system that has adequate critical care capacity to provide treatment to the sickest of COVID-19 patients, we were able to limit disparities in mortality despite the social factors that contribute to AAs presenting with higher rates of comorbid illnesses on admission.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40615-021-00966-0>.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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