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Letter to the Editor

Outcomes of in-hospital cardiac arrest in patients with COVID-19 in New York City

Cardiopulmonary resuscitation (CPR) in patients with in-hospital cardiac arrest (IHCA) has been associated with poor overall survival and neurologic recovery.[1] The coronavirus 2019 (COVID-19) global pandemic carries a high mortality rate with high risk of cardiopulmonary arrest.[2] Clear policies for crisis standards of care and CPR are essential in light of limited Intensive Care Unit (ICU) resources and aerosolized transmission among code team members.[3] There is limited literature regarding the survival outcomes and effectiveness of CPR in patients with COVID-19 who suffer cardiac arrest.[4] Here, we describe our experience with performing CPR in patients with COVID-19 who developed IHCA.

This retrospective case series included patients 18 years of age or older with confirmed COVID-19 who subsequently had an IHCA between March 1st and May 18th, 2020, at a 500-bed teaching hospital in Manhattan. COVID-19 cases were confirmed using a reverse-transcriptase polymerase chain reaction assay. Data were manually abstracted from electronic health records with the use of a standardized abstraction process. We identified 31 patients who met the inclusion criteria. Patients were grouped based on whether they suffered a cardiac arrest in ICU or non-ICU setting.

Of the 31 patients, the median age was 69 (IQR 57−76) years, 71% were male, and 55% had cardiovascular disease (Table 1). 24 patients (77%) developed IHCA in the ICU and 7 (23%) in a non-ICU setting. The initial rhythm was PEA in 18 (58%) patients, asystole in 9

(29%) patients, and ventricular tachycardia or fibrillation in 4 (13%) patients. 18 (58%) patients were on mechanical ventilation before the arrest. The median PaO2/FiO2 (P/F) ratio was 77 (IQR 61−123), with a higher SOFA score in ICU patients versus non-ICU (12 vs. 4, $p = 0.01$). Patients in non-ICU settings had higher median inflammatory markers and serum creatinine levels, however this did not reach statistical significance. The median resuscitation time was 14 minutes (IQR 8−20). 13 (42%) patients survived the initial cardiac event, of which 12 were in an ICU setting. Of the total 31 patients, none survived to hospital discharge. The median survival time until death was 2.8 h (IQR 1.5−13.3).

In this series of patients with COVID-19 who suffered IHCA, there was a high prevalence of respiratory etiology of arrest, low P/F ratio, and extremely poor prognosis. The most frequent underlying comorbidity was cardiovascular disease, which is consistent with reports globally. Despite an initial survival rate of 42% in our case series, the overall mortality was 100%, with very short-term survival until death in those individuals who achieved ROSC. The findings of low P/F ratio and high SOFA scores demonstrate the severity of illness in these patients with COVID-19 that suffered IHCA, and speaks to their poor prognosis. Further research is necessary to understand whether these poor outcomes after IHCA can be extrapolated to the larger population of patients with COVID-19 and guide institutional policies around cardiopulmonary resuscitation.

Table 1 – Characteristics of 31 COVID-19 patients with In-Hospital Cardiac Arrest (IHCA).				
Characteristic	Total (N=31)	Non-ICU (N=7)	ICU (N=24)	p-value
Median age (IQR − yr)	69 (57−76)	69 (57−77)	69 (56−76)	0.77
Male sex − no. (%)	22 (71)	6 (86)	16 (67)	0.64
Median body mass index	26.9 (23−31)	25.0 (21−29)	27.4 (24−33)	0.29
Race or ethnic group − no. (%)				
White	8 (26)	2 (27)	6 (25)	1.00
African American	13 (42)	4 (57)	9 (38)	0.40
Hispanic	6 (19)	1 (14)	5 (21)	1.00
Asian	2 (6)	0 (0)	2 (8)	1.00
Other	2 (6)	0 (0)	2 (8)	1.00
Comorbidities − no. (%)				
Heart disease	17 (55)	7 (100)	10 (42)	0.01

Table 1 *(continued)*

Characteristic	Total (*N*=31)	Non-ICU (*N*=7)	ICU (*N*=24)	*p*-value
Diabetes mellitus	13 (42)	3 (38)	10 (43)	0.67
Chronic kidney disease	6 (19)	3 (43)	3 (13)	0.11
End stage renal disease	3 (10)	0 (0)	3 (12.5)	1.00
Asthma or chronic obstructive pulmonary disease	13 (42)	2 (29)	11 (46)	0.67
Venous thromboembolism	2 (6)	1 (14)	1 (4)	0.41
Cancer	5 (16)	1 (14)	4 (17)	1.00
Median laboratory values on admission − (IQR)				
Absolute lymphocyte count − K/uL	0.85 (0.7−1.1)	0.7 (0.5−1.1)	0.9 (0.7−1.4)	0.30
Creatinine − mg/dL	1.3 (0.9−7.0)	7.0 (1.3−8.7)	1.1 (0.8−1.9)	0.06
Ferritin − ng/ml	1322 (814−3398)	2698 (1317−6349)	1232 (764−2929)	0.17
C-reactive protein − mg/L	199 (73−253)	238 (73−245)	183 (73−260)	0.77
Lactate dehydrogenase − U/L	772 (465−1243)	1258 (1160−2458)	685 (463−963)	0.06
D-dimer − mg/ml	0.95 (0.35−2.48)	2.6 (1.40−3.54)	0.83 (0.35−2.07)	0.04
Interleukin 6 − pg/mL	92 (48−206)	255 (96−1046)	87 (48−179)	0.32
Lactate − mmol/L	1.2 (0.8−1.6)	1.2 (0.9−1.6)	1.3 (0.8−1.6)	0.87
Median laboratory values on day of IHCA − (IQR)				
Absolute lymphocyte count − K/μL	0.65 (0.3−0.9)	0.6 (0.5−1.9)	0.7 (0.4−0.9)	0.35
Creatinine − mg/dL	3.0 (1.0−6.3)	3.0 (1.0−7.4)	3.0 (1.0−5.0)	0.39
Ferritin − ng/ml	2137 (1078−4462)	4003 (1317−8876)	2111 (918−3172)	0.18
C-reactive protein − mg/L	171 (64−286)	207 (171−240)	111 (64−294)	0.45
Lactate dehydrogenase − U/L	915 (692−1131)	1026 (597−2458)	914 (704−1097)	0.78
D-dimer − mg/ml	3.75 (2.63−8.92)	6.24 (3.64−10.82)	3.38 (2.26−8.13)	0.26
Lactate − mmol/L	2.8 (1.7−9.8)	3.4 (1.7−8.1)	2.8 (1.07−9.8)	1.00
Treatment for COVID-19 − no. (%)				
Corticosteroids	24 (77)	3 (43)	21 (88)	0.03
Azithromycin	28 (90)	5 (7)	23 (96)	0.56
Hydroxychloroquine	26 (84)	4 (57)	22 (92)	0.06
Therapeutic anticoagulation	20 (65)	2 (29)	18 (75)	0.07
Anti-interleukin-6	13 (42)	1 (14)	12 (50)	0.19
Convalescent plasma	3 (9.68)	0 (0)	3 (13)	1.00
Remdesivir	1 (3.23)	0 (0)	1 (4)	1.00
Oxygen delivery at time of IHCA − no. (%)				
Low-flow nasal cannula	2 (6)	1 (14)	1 (4)	0.40
Non-rebreather	1 (3)	1 (0)	0 (0)	0.23
Non-invasive ventilation	6 (19)	2 (29)	4 (17)	0.60
High-flow nasal cannula	4 (13)	1 (14)	3 (13)	1.00
Mechanical ventilator	18 (58)	2 (29)	16 (67)	0.09
Severity of illness markers at time of IHCA				
P/F ratio − median (IQR)	77 (61−123)	153 (68−263)	72 (59−114)	0.12
Sequential Organ Failure Assessment (SOFA) Score − mean (SD)	9 (4−13)	4 (3−5)	12 (5.5−14)	0.01
Characteristics of IHCA				
Initial rhythm − no. (%)				
PEA	18 (58)	5 (71)	13 (54)	0.70
Asystole	9 (29)	1 (14)	8 (33)	0.60
VF/VT	4 (13)	1 (14)	3 (13)	1.00
ROSC	20 (65)	3 (43)	17 (71)	0.20
Shock delivered	7 (23)	3 (43)	4 (17)	0.30
Survived cardiac event (>20 min)	13 (42)	1 (14)	12 (50)	0.20
Median arrest time (IQR − min)	14 (8−20)	12 (10−21)	15 (7−19)	0.40
Etiology of arrest − no. (%)				
Respiratory	24 (77)	7 (100)	17 (71)	0.16
Metabolic	5 (16)	0 (0)	5 (21)	0.56
Cardiac	2 (6)	0 (0)	2 (8)	1.00
Characteristics of hospital stay (IQR − days) median				
Hospital LOS	13 (5−12)	5 (2−9)	14 (11−22)	0.003
Intensive care unit LOS	5 (1−14)	0.0	11 (2−15)	<0.001
Ventilator days	2 (1−9)	1 (0−1)	5 (1−12)	0.003
Admission to cardiac arrest	12 (4−16)	4 (1−8)	13 (10−19)	0.003
Survived cardiac event to mortality (IQR − hours) median	2.8 (1.5−13.3)	1.2 (1.2−1.2)	3.7 (1.6−13.7)	0.28
Mortality	31 (100)	7 (100)	24 (100)	

Conflict of interest

None declared.

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