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Cardiovascular comorbidities, cardiac injury, and prognosis of COVID-19 in New York City



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Using Mt. Sinai (New York City) EMR health system data, we retrospectively analyzed a cohort of 8438 COVID-19 patients seen between March 1 and April 22, 2020. Risk of intubation and of death rose as a function of increasing age and as a function of greater cardiovascular comorbidity. Combining age and specific comorbidity markers showed patterns suggesting that cardiovascular comorbidities increased relative risks for adverse outcomes most substantially in the younger subjects with progressively diminishing relative effects at older ages. (Am Heart J 2020;226:24-5.)

Research letters

Coronavirus disease 2019 (COVID-19) caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2, has spread all around the world since December 2019.¹ As of April 22, its epicenter is New York.² Previous studies demonstrated that cardiac injury or comorbidities increased the risk of in-hospital mortality in patients with COVID-19.^{3,4} The aim of this study is to investigate whether cardiovascular disease or cardiac injury increased the risk of mechanical ventilation or mortality using the electronic medical records (EMR) of Mount Sinai Health System in New York City.⁵

We analyzed the EMR of COVID-19 positive patients from Mount Sinai Health System which used EPIC electronic health record system from March 1st to April 22nd, 2020. Mount Sinai health system combines 7 hospitals with more than 3800 beds and more than 410 ambulatory practices across metropolitan New York. Among 8438 patients, 54.7% of patients (N = 4616) were admitted to these hospitals. Analysis was performed on April 30th, 2020, which included patients who remained in the hospitals.

Age, coronary artery disease (CAD), peripheral artery disease (PAD), heart failure, and cardiac injury as well as necessity of mechanical ventilation and mortality among patients with positive polymerase chain reaction test of COVID-19 were extracted. Cardiac injury was defined as troponin I elevation which was defined as 99th percentile upper reference limit. Patients with cardiac injury were compared with those without troponin I elevation among

a total of 5320 patients' measurements (63.0%).⁶ Mount Sinai Health System waived institutional review board approval since this research used only deidentified, aggregate-level data.⁵ No extramural funding was used to support this work and the authors are solely responsible for the design and conduct of this study, all study analyses, the drafting and editing of the paper and its final contents.

Among 8438 patients with COVID-19, 8.6% of patients had CAD, 8.1% of patients had PAD, 6.9% of patients had heart failure. **Table I** shows baseline characteristics of this cohort. 43.5% of patients had troponin I elevation among patients who had troponin I measurements. **Table II** shows the crude rates of mechanical ventilation and mortality. Patients with a CAD, PAD, or heart failure had significantly higher rates of mechanical ventilation and mortality. Notably, cardiac injury demonstrated significantly higher relative risk (RR) of mechanical ventilation (3.45 [95% confidence interval 2.87-4.14]) and of mortality (5.07 [4.45-5.76]) (**Table II**). We detected

Table I. Baseline characteristics of total cohort

	Number of patients: % (patient number) 8438 patients
Age median [IQR]	59 [43, 71]
Male	53.9% (4544)
White	25.8% (2179)
African American	22.7% (1913)
Hypertension	28.2% (2380)
Hyperlipidemia	17.1% (1446)
Diabetes Mellitus	19.0% (1606)
Coronary artery disease	8.6% (723)
Peripheral artery disease	8.1% (680)
Heart failure	6.9% (584)
Chronic kidney disease	12.4% (1049)
Dialysis	1.7% (140)
Chronic obstructive lung disease	2.4% (200)
Asthma	8.7% (735)
Cancer	7.0% (589)
Human Immunodeficiency Virus	1.4% (121)

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Table II. Incidence of intubation and mortality for patients with cardio-vascular diseases for COVID-19 patients

Age Group	Intubation, % (event/total)			Death, % (event/total)		
	With CAD	Without CAD	RR (95% CI)	With CAD	Without CAD	RR (95% CI)
All ages	11.6% (84/723)	6.2% (475/7715)	1.88 (1.52-2.35)	30.2% (218/723)	13.4% (1035/7715)	2.24 (1.98-2.55)
≤ 50	16.0% (4/25)	3.2% (90/2851)	5.07 (2.02-12.7)	8.0% (2/25)	2.0% (56/2851)	4.07 (1.05-15.8)
51-65	11.7% (21/179)	7.1% (158/2237)	1.66 (1.08-2.55)	19.0% (34/179)	10.4% (233/2237)	1.82 (1.32-2.53)
66-80	13.8% (45/327)	9.4% (165/1751)	1.46 (1.07-1.99)	31.5% (103/327)	21.8% (382/1751)	1.44 (1.20-1.73)
≥ 80	7.3% (14/192)	7.1% (62/876)	1.03 (0.59-1.80)	41.1% (79/192)	41.6% (364/876)	0.99 (0.82-1.19)
	With PAD	Without PAD	RR (95% CI)	With PAD	Without PAD	RR (95% CI)
All ages	11.3% (77/680)	6.2% (482/7758)	1.82 (1.45-2.29)	23.2% (158/680)	14.1% (1095/7758)	1.64 (1.42-1.91)
≤ 50	7.5% (5/67)	3.2% (89/2809)	2.36 (0.99-5.61)	7.5% (5/67)	1.9% (53/2809)	3.96 (1.63-9.58)
51-65	13.0% (25/192)	6.9% (154/2224)	1.88 (1.27-2.79)	15.6% (30/192)	10.7% (237/2224)	1.47 (1.03-2.08)
66-80	13.3% (37/278)	9.6% (173/1800)	1.38 (0.99-1.93)	25.9% (72/278)	22.9% (413/1800)	1.13 (0.91-1.40)
≥ 80	7.0% (10/143)	7.1% (66/925)	0.98 (0.52-1.86)	35.7% (51/143)	42.4% (392/925)	0.84 (0.67-1.06)
	With HF	Without HF	RR (95% CI)	With HF	Without HF	RR (95% CI)
All ages	14.6% (85/584)	6.0% (474/7854)	2.41 (1.94-2.99)	34.2% (200/584)	13.4% (1053/7854)	2.55 (2.25-2.90)
≤ 50	18.8% (9/48)	3.0% (85/2828)	6.24 (3.34-11.7)	10.4% (5/48)	1.8% (53/2828)	5.56 (2.33-13.3)
51-65	14.1% (20/142)	7.0% (159/2274)	2.01 (1.31-3.11)	24.6% (35/142)	10.2% (232/2274)	2.42 (1.77-3.30)
66-80	19.4% (45/232)	8.9% (165/1846)	2.17 (1.61-2.93)	39.2% (91/232)	21.3% (394/1846)	1.84 (1.53-2.21)
≥ 80	6.8% (11/162)	7.2% (65/906)	0.95 (0.51-1.75)	42.6% (69/162)	41.3% (374/906)	1.03 (0.85-1.25)
	With Cardiac Injury	Without Cardiac Injury	RR (95% CI)	With Cardiac Injury	Without Cardiac Injury	RR (95% CI)
All	16.7% (387/2312)	4.9% (146/3008)	3.45 (2.87-4.14)	41.3% (954/2312)	8.1% (245/3008)	5.07 (4.45-5.76)
≤ 50	26.8% (40/149)	5.4% (44/819)	5.00 (3.38-7.39)	23.4% (35/149)	2.7% (22/819)	8.74 (5.28-14.5)
51-65	22.5% (126/561)	4.4% (46/1050)	5.13 (3.72-7.07)	33.0% (185/561)	6.7% (70/1050)	4.95 (3.83-6.38)
66-80	17.4% (157/902)	5.5% (47/860)	3.18 (2.33-4.35)	42.5% (383/902)	10.0% (86/860)	4.25 (3.43-5.26)
≥ 80	9.1% (64/700)	3.2% (9/279)	2.83 (1.43-5.62)	50.1% (351/700)	24.0% (67/279)	2.09 (1.67-2.61)

CAD, coronary artery disease; CI, Confidential interval; HF, heart failure; PAD, peripheral artery disease; RR, relative risk.

higher rates of mechanical ventilation and mortality in patients with CAD, PAD and heart failure in all age groups except >80 years, with relatively higher RR in younger population (Table II).

Our study revealed increased risk of mechanical ventilation and mortality in patients with cardiovascular comorbidities or cardiac injury. Since we present crude event rates, further study is needed to confirm our findings.

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