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## Myocardial injury associated with coronavirus disease 2019 in pregnancy.

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1 **Myocardial injury associated with coronavirus disease 2019 in pregnancy**

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31 The authors report no conflict of interest.

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33 **Objective:**

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35 Coronavirus disease 2019 (COVID-19) is associated with cardiac injury<sup>1-3</sup> and bradycardia<sup>4</sup> in  
36 the non-pregnant population. The incidence of these complications in pregnancy is unknown.

37 The objective of this study was to determine the rate of abnormal serum cardiac biomarkers or  
38 bradycardia among pregnant and immediately postpartum women admitted for treatment of  
39 severe or critical COVID-19 in a large integrated health system in New York.

40

41 **Study Design:**

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43 This is a retrospective review of all pregnant and immediately postpartum women hospitalized  
44 for COVID-19 at 7 hospitals within Northwell Health, the largest academic health system in  
45 New York state, from March 1 to April 30, 2020. Women who tested positive for severe acute  
46 respiratory syndrome coronavirus 2 (SARS-CoV-2) by polymerase chain reaction (PCR) assay  
47 and who met the National Institute of Health (NIH) criteria for severe or critical illness<sup>5</sup> were  
48 included. Women with a positive PCR test who were admitted for a reason other than treatment  
49 of COVID-19 (eg, labor) were excluded. The Northwell Health Institutional Review Board  
50 approved the study as minimal-risk research using data collected for routine clinical practice and  
51 waived the requirement for informed consent.

52

53 Clinical records were manually reviewed. Data collected included demographics, medical  
54 comorbidities, pregnancy characteristics, laboratory and imaging results, medications  
55 administered, and clinical outcomes. Laboratory and imaging studies were ordered at the

56 discretion of the attending physician. The primary outcomes evaluated were elevated cardiac  
57 troponins (I, T, or high sensitivity), elevated brain natriuretic peptide (BNP), bradycardia  
58 (defined as < 60 beats per minute, bpm), and maternal heart rate (HR) nadir. Descriptive  
59 statistics were used to characterize the data.

60

61 **Results:**

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63 A total of 31 women met inclusion criteria; 20 (65%) had cardiac biomarkers measured during  
64 hospitalization (Table). Cardiac troponins and BNP were elevated in 22% (n=4/18) and 30%  
65 (n=3/10) of these patients, respectively. Four patients had transthoracic echocardiograms  
66 performed and all were reported as normal. No patients had preexisting cardiovascular disease or  
67 hypertension. Two maternal mortalities in this cohort were previously reported;<sup>6</sup> both patients  
68 had elevated cardiac troponins and one also had an elevated BNP.

69

70 The nadir HR ranged from 30-92 bpm and bradycardia occurred in one-third of patients  
71 (n=10/31). Half of women with elevated troponin and three-fourths of women with elevated BNP  
72 had an episode of bradycardia recorded during their hospital course.

73

74 **Conclusion:**

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76 Myocardial injury as demonstrated by abnormal cardiac biomarkers and bradycardia may be  
77 common among pregnant women with severe or critical COVID-19. In this study, one-fifth of  
78 patients who had troponin levels measured were found to have elevations (one-eighth of the

79 overall study population). Among patients who had brain natriuretic peptide levels measured,  
80 30% were elevated (10% of the overall study population). One third of women had bradycardia.

81

82 This study is limited by a small sample size. Laboratory testing and imaging was not uniform  
83 due to the retrospective nature of the study. Sampling bias was unavoidable because the decision  
84 to measure cardiac markers or perform imaging studies was made by the patient's care team,  
85 based on clinical presentation rather than a formal protocol.

86

87 Few studies have evaluated the risk of cardiac injury or arrhythmia among pregnant women with  
88 COVID-19. It is also unknown whether there are long-term sequelae that affect maternal health  
89 or future pregnancy outcomes. This is an important area of focus for future research.

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102 **Acknowledgements:**

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104 We would like to acknowledge the efforts of the healthcare workers caring for pregnant women

105 during the global COVID-19 pandemic.

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151 **Table: Characteristics of patients with normal and abnormal cardiac markers:**

<b>Characteristic</b>	<b>Patients with normal cardiac biomarkers (n = 13)</b>	<b>Patients with elevated cardiac biomarkers (n = 7)</b>
Maternal age (years)	33 ± 4.4	32 ± 4.5
≥ 35 years	2 (15.4%)	3 (42.9%)
<u>Race or Ethnicity</u>		
Caucasian	5 (38.5%)	2 (28.5%)
African American	2 (15.4%)	0
Hispanic	6 (42.8%)	0
Asian	0	3 (42.8%)
Other/Unknown/Multiracial	0	2 (28.5%)
Multiparous	9 (69.2%)	7
Parity of 3 or more	3 (23.1%)	2 (28.5%)
BMI prepregnancy (kg/m <sup>2</sup> )	34.7 ± 6.7	32.5 ± 6.0
≥ 30 kg/m <sup>2</sup>	8 (61.5%)	5 (71.4%)
<u>Medical comorbidities</u>		
Hypertension	0	0
Diabetes	0	1 (14.3%)
Asthma	1 (7.7%)	1 (14.3%)
Pre-existing cardiac disease	0	0
<u>Pregnancy complications</u>		
Gestational diabetes	1 (7.7%)	0

Gestational hypertension or preeclampsia	3 (23.1%)	2 (28.5%)
<u>COVID-19</u>		
Gestational age at hospitalization, wk	33.5 [10.8]	34.5 [4.5] (1 postpartum)
<u>Reported symptoms</u>		
Fever, subjective or measured	9 (69.2%)	6 (85.7%)
Cough	8 (61.5%)	6 (85.7%)
Dyspnea	9 (69.2%)	6 (85.7%)
Nausea or diarrhea	1 (7.7%)	1 (14.3%)
Other	0	1 (14.3%, abdominal pain)
<u>Medications</u>		
Hydroxychloroquine	11 (84.6%)	3 (42.8%)
Corticosteroids	5 (38.5%)	4 (57.1%)
Remdesivir	0	2 (28.5%)
Interleukin Inhibitors	1 (7.7%)	3 (42.8%)
Convalescent plasma	0	1 (14.3%)
<u>Vital signs</u>		

Temperature, $\geq 100.4\text{F}$ or $38.0\text{C}$	6 (42.8%)	5 (71.4%)
Max heart rate, $>100$ beats per minute	10 (76.9%)	6 (85.7%)
Min heart rate, $<60$ beats per minute	6 (42.8%)	3 (42.8%)
Respiratory rate, $>30$ breaths per minute	4 (30.7%)	4 (57.1%)
Oxygen saturation (minimum), %	$87.8 \pm 6.2$	$84.6 \pm 10.2$
$\leq 93\%$	11 (84.6%)	5 (71.4%)
<b><u>Biomarkers</u></b>		
BNP $> 300$ pg/mL	0	4 (57.1%)
hs-Trop $> 6 - 14$ ng/L	0	1 (14.3%)
Troponin T $> 0.06$ ng/mL	0	1 (14.3%)
Troponin I $> 0.045$ ng/mL	0	2 (28.5%)
Echocardiogram	1 (7.7%)	3 (42.8%)
Number of days admitted to hospital	8 [11]	4 [9]
Intensive care unit admission	5 (38.5%)	6 (85.7%)
Maternal mortality	0	2 (28.5%)

152 Data are presented as n (%), median [interquartile range], or mean  $\pm$  standard deviation unless

153 otherwise specified.

154 bpm, beats per minute.

155 Reference ranges: high sensitivity cardiac troponins  $< 6 - 14$  ng/L, troponin T  $0.00 - 0.06$

156 ng/mL, troponin I  $0.000 - 0.045$ , BNP  $< 300$  pg/mL.

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