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PII: S0002-9378(20)31188-1

DOI: https://doi.org/10.1016/j.ajog.2020.10.014

Reference: YMOB 13540

To appear in: *American Journal of Obstetrics and Gynecology*

Received Date: 5 October 2020

Accepted Date: 8 October 2020

Please cite this article as: PACHTMAN SHETTY SL, MEIROWITZ N, BLITZ MJ, GADOMSKI T, WEINBERG CR, Myocardial injury associated with coronavirus disease 2019 in pregnancy, *American Journal of Obstetrics and Gynecology* (2020), doi: https://doi.org/10.1016/j.ajog.2020.10.014.

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The authors report no conflict of interest.

Word count: 542

Objective:

Coronavirus disease 2019 (COVID-19) is associated with cardiac injury[1-3] and bradycardia[4] in the non-pregnant population. The incidence of these complications in pregnancy is unknown. The objective of this study was to determine the rate of abnormal serum cardiac biomarkers or bradycardia among pregnant and immediately postpartum women admitted for treatment of severe or critical COVID-19 in a large integrated health system in New York.

Study Design:

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

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

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

Results:

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

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

Conclusion:

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

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

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

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

Acknowledgements:

We would like to acknowledge the efforts of the healthcare workers caring for pregnant women during the global COVID-19 pandemic.

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

Characteristic	**Patients with normal cardiac biomarkers (n = 13)**	**Patients with elevated cardiac biomarkers (n = 7)**
Maternal age (years)	33 ± 4.4	32 ± 4.5
≥ 35 years	2 (15.4%)	3 (42.9%)
Race or Ethnicity		
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^2)	34.7 ± 6.7	32.5 ± 6.0
≥ 30 kg/m^2	8 (61.5%)	5 (71.4%)
Medical comorbidities		
Hypertension	0	0
Diabetes	0	1 (14.3%)
Asthma	1 (7.7%)	1 (14.3%)
Pre-existing cardiac disease	0	0
Pregnancy complications		
Gestational diabetes	1 (7.7%)	0

Gestational hypertension or preeclampsia	3 (23.1%)	2 (28.5%)
COVID-19		
Gestational age at hospitalization, wk	33.5 [10.8]	34.5 [4.5] (1 postpartum)
Reported symptoms		
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)
Medications		
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%)
Vital signs		

Temperature, ≥100.4F or 38.0C	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 ± 6.2	84.6 ± 10.2
≤93%	11 (84.6%)	5 (71.4%)
Biomarkers		
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%)

Data are presented as n (%), median [interquartile range], or mean ± standard deviation unless otherwise specified.

bpm, beats per minute.

Reference ranges: high sensitivity cardiac troponins < 6 – 14 ng/L, troponin T 0.00 – 0.06 ng/mL, troponin I 0.000 – 0.045, BNP < 300 pg/mL.