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## Pericardial effusion in COVID-19 patients



Dear Editor:

Pericardial effusion is a well-known complication of several viral infections, such as Influenza virus, Coxsackievirus, and Echovirus. Apart from case reports and small retrospective observational studies, little is known about the incidence of COVID-19-related pericardial effusion.<sup>1</sup> In patients without preexisting cardiac disease, COVID-19 has been shown to cause congestive heart failure, myocarditis, Takotsubo cardiomyopathy, and myocardial infarction through direct and indirect effect on the myocytes.<sup>2</sup> Several hypotheses exist suggesting that COVID-19-induced pericardial effusion is a result of a severe inflammatory process than direct infectious cause.<sup>3</sup>

This study was a retrospective review of all adult COVID-19 patients admitted to Albany Medical Center (AMC) in Albany, New York, between the dates of March 1st, 2020 to January 10th, 2021. This study was approved by the AMC Institutional Review Board under number IRB protocol of #5825. Patients were diagnosed via real-time reverse transcription-polymerase chain reaction (RT-PCR) from a nasopharyngeal swab. COVID-19 patients who had an echocardiography performed as part of their standard medical care during hospitalization and found to have pericardial effusions were included in this case series. The most common indications for ordering echocardiography were identifying superimposed cardiogenic pulmonary in patients with COVID-19 related ARDS and assessing Bi-Ventricular function in patients with undifferentiated shock. The following data were collected for each patient in the study: (a) Demographics of age, sex, and ethnicity; (b) Comorbidities of coronary arterial disease, chronic pulmonary disease, diabetes mellitus, hypertension, and cancer; (c) Admission laboratory parameters of procalcitonin, ferritin, C-reactive protein (CRP), and D-dimer levels; (d) COVID-19 treatment such as Remdesivir, therapeutic anti-coagulation, corticosteroids, and convalescent plasma; (e) echocardiography findings of right ventricular size, function, right ventricular systolic pressure, left ventricular ejection fraction, pericardial effusion size, and pericardiocentesis requirement; and (f) Outcomes of in-hospital mortality, 28-day ventilator-free days, 28-day ICU-free days and 28-day hospital-free days.

A total of 1002 patients with COVID-19 infection were admitted to AMC during the study period. Echocardiography was performed on 195 of these, of which 4.6% (9/195) had evidence of pericardial effusions. The baseline clinical characteristics of COVID-19 patients with pericardial effusions are shown in [Table 1](#). The mean/median age of patients were 60 and 66 years, respectively, and 33% (3/9) of the patients were male. The most common

comorbidity was hypertension in 67% (6/9) of cases, followed by coronary artery disease at 44% (4/9), one patient had a past medical history of End Stage Kidney Disease 11% (1/9), and none had personal history of rheumatological diseases or evidence of bacteremia during their hospitalization. More than half of the patients received high-dose corticosteroids [55% (5/9)], but only 22.2% (2/9) received Remdesivir. 88.9% (8/9) of pericardial effusions identified on echocardiogram were small and the remaining one was moderate in size. None of these pericardial effusion patients required pericardiocentesis or fluid analysis were performed, and one patient had evidence of pericarditis on her electrocardiogram (EKG). 22.2% (2/9) of the patients had follow-up echocardiogram with persistent pericardial effusions identified. One-third (3/9) of the patients required ICU admission, of which two were mechanically ventilated. Finally, one-third (3/9) of the pericardial effusion patients died during their hospitalization. Other clinical outcomes are demonstrated in [Table 2](#).

**TABLE 1.** Baseline demographics of COVID 19 patients with pericardial effusion.

Variables	Patients with Pericardial Effusion N = 9
Age-Year; Mean (SD)	66 (15.8)
Sex- N (%)	
Male	3 (33.3%)
Female	6 (66.7%)
Ethnicities- N (%)	
White	6 (66.7%)
Black	2 (22.2%)
Unknown/Not Reported	1 (11.1%)
BMI Mean (SD)	29.5 (9.6)
Comorbidities- N (%)	
One Comorbidity	7 (77.7%)
Chronic Pulmonary Disease	5 (55.5%)
Diabetes Mellitus	2 (22.2%)
Coronary Artery Disease	4 (44.4%)
Hypertension	6 (66.7%)
Cancer	0 (0%)
Inflammatory markers Mean (SD)	
Procalcitonin (ng/mL)	5 (12.7)
Ferritin (ng/mL)	183.5 (181.3)
C-RP (mg/L)	50 (57.6)
D-Dimer (ng/mL)	4 (7.2)
Treatment- N (%)	
Corticosteroid	5 (55.5%)
Convalescent Plasma	4 (44.4%)
Therapeutic Anti-Coagulation	2 (22.2%)
Remdesivir	2 (22.2%)

**TABLE 2.** Association between presence of pericardial effusion and clinical outcome.

Outcome	Patients with Pericardial Effusion N = 9
Mortality N (%)	3 (33.3%)
Number of days on ventilator; Mean, SD (N = 3)	9, 9
Number of ICU Days; Mean, SD (N = 3)	10, 6.5
Hospital Length of Stay; Mean, SD	20, 14.1
28 Ventilator free days; Mean, SD (N = 3)	6.5, 9.1
28 ICU free days; Mean, SD (N = 3)	3.6, 6.4
28 Hospital free days; Mean, SD	6, 9.1

Among 195 COVID-19 patients admitted to our tertiary care center who received echocardiography, the incidence of unprompted pericardial effusion was up to 4.6%. Our cohort data suggest that the presence of pericardial effusion in patients requiring mechanical ventilation led to extended ventilation times along with extended hospital stay. These patients subsequently had fewer ICU and ventilator free days.

Several case reports have discussed the incidence of pericardial effusion in COVID-19 patients. A prospective study found pericardial effusion in exceptionally 22% of COVID-19 patients more than two weeks after testing positive on RT-PCR.<sup>4</sup> An observational study assessing the radiologic findings of COVID-19 patients also described an increased incidence of pericardial effusion.

It remains unclear if the occurrence of pericardial effusion in COVID-19 patients is related to underlying myocarditis or pericarditis. An observational study reported the incidence of myocarditis to be as high as 7% among 150 COVID-19 patients.<sup>5</sup> Prior reports have correlated an incidence of pericardial effusion in patients with elevated cardiac troponin from less than 1% to as high as 10% in patients diagnosed with myocarditis.<sup>6</sup> In much of the literature published on echocardiographic characteristics in COVID-19 patients, the focus was to demonstrate dynamics of ventricular action in diagnosis of myocarditis.<sup>7,8</sup> Nevertheless, the true incidence of pericarditis in the setting of myopericarditis is not clear due to the limit on healthcare worker to patient exposure causing a reduction in the use of echocardiogram and avoidance of aerosolized-generating procedure, such as pericardial drainage of pericardial effusion. Furthermore, results of RT-PCR testing of pericardial effusion after pericardiocentesis have returned negative, casting doubts on SAR-CoV-2 direct invasion of myocardium or pericardium causing pericardial effusions.<sup>9</sup> Systemic inflammation as the cause of pericardial effusion in COVID-19 patients has been increasingly favored based on the evidence from multiple recent medical literatures.<sup>10</sup>

There are several limitations to our study. First, the true incidence of COVID-19-related pericardial effusion is likely underestimated as not all COVID-19 patients admitted to our institution had an echocardiogram

performed. Second, we are unable to determine if these patients had chronic effusions in the setting of their underlying comorbidities or if these pericardial effusions developed acutely during COVID 19 infection as screening echocardiogram was not performed during initial admission. Lastly, this is a retrospective study, we had limited data on exclusion alternative causes of pericardial effusion such as hypothyroidism, collagen vascular disease and renal failure. To date, this is the largest retrospective analysis of pericardial effusions in COVID-19 patients.

In conclusion, the incidence of COVID-19-related pericardial effusions appears to be low at 4.6% in our sample of COVID-19 patients. Other causative factors should be ruled out in COVID-19 patients diagnosed with pericardial effusions. Prior medical history may also play a key factor in presence of pericardial effusions in any patient examined with echocardiography. Further well-designed, large prospective studies are needed to determine the true incidence of pericardial effusions in COVID-19 patients.

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