Prognostic utility of quantitative offline 2D-echocardiography in hospitalized patients with COVID-19

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Background: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was declared as a pandemic by the World Health Organization (WHO) on 11 March 2020. Clinical presentation ranges from asymptomatic to acute respiratory distress syndrome (ARDS) that can lead to death. Patients with concomitant cardiac diseases have an extremely poor prognosis, and SARS-CoV-2 may cause direct acute and chronic damage to the cardiovascular system. Echocardiography may provide useful information, especially in critical care patients, because it can be performed quickly at the bedside. However, the recommendations relating to the use of echocardiography in the COVID-19 pandemic must be considered only as expert suggestions due to the lack of evidence-based scientific outcome data. To date, there is no means to predict the impact of the virus on patient outcome probably because the pathophysiology of COVID-19 remains unexplained.

Purpose: To assess the prognostic utility of quantitative 2D-echocardiography, including strain, in patients with COVID-19 disease.

Methods: COVID-19 patients admitted to the San Paolo University Hospital of Milan, that underwent a clinically indicated echocardiographic exam were included in the study. To limit contamination all measurements were performed offline. Quantitative measurements were obtained by an operator blinded to the clinical data.

Results: Among the 49 patients, non-survivors (33%) had worse respiratory parameters, index of multiorgan failure and worse markers of lung involvement. Right Ventricular (RV) dysfunction (as assessed by conventional and 2-dimensional speckle tracking, fig. 1) was a common finding and a powerful independent predictor of mortality. At the ROC curve analyses, RV free-wall longitudinal strain (LS) showed an AUC 0.77 ± 0.08 in predicting death, p = 0.008, and global RV LS (RV-GLS) showed an AUC 0.79 ± 0.04, p = 0.004. This association remained significant after correction for age (OR= 1.16, 95%CI 1.01-1.34, p = 0.029 for RV free-wall LS and OR = 1.20, 95%CI 1.01-1.42, p = 0.033 for RV-GLS), for oxygen partial pressure at arterial gas analysis/fraction of inspired oxygen (OR= 1.28, 95%CI 1.04-1.57, p = 0.021 for RV free wall-LS and OR = 1.30, 95%CI 1.04-1.62, p = 0.020 for RV-GLS) and for the severity of pulmonary involvement measured by a computed tomography lung score (OR = 1.27, 95%CI 1.02-1.19, p = 0.034 for RV free-wall LS, and OR = 1.30, 95%CI 1.04-1.63, p = 0.022 for RV-GLS).

Conclusions: In patients hospitalized with COVID-19, offline quantitative 2D-echocardiographic assessment of cardiac function is feasible. Parameters of RV function are frequently abnormal and have an independent prognostic value over markers of lung involvement. Early identification of RV dysfunction with speckle tracking might be useful not only to guide management acutely (i.e. fluid management, monitoring high-PEEP response in intubated patients) but also to tailor follow-up subsequently.

Abstract Figure 1