

Baseline echocardiographic assessment of left ventricle kinetics alteration and mortality risk in a cohort of critically ill COVID-19 patients

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Abstract

Background SARS-CoV2 infection are frequently associated with cardiovascular manifestations, in particular with symptomatic acute coronary syndromes, cardiac arrhythmias and acute heart failure. However, the elevation of serum troponin seems to be non specific, and a cardiologic diagnostic workup should be performed. We aimed to assess the clinical characteristic and the prevalence of left ventricular (LV) dyssynergy patterns in a cohort of hospitalized non-critically ill COVID-19 patients

Methods Consecutive patients with an objective diagnosis of COVID-19, from February to April 2020. Baseline characteristics and comorbidities was collected. In case of increased troponin levels or symptoms suggestive for a concomitant cardiac syndrome, patients undergo to serial electrocardiograms, serial Troponin tests and bedside transthoracic echocardiogram.

Results 402 consecutive patients were enrolled: 55 patients underwent an echocardiographic exam because of an increase in troponin levels or a suspected myocardial injury. Segmental left ventricular abnormalities were found in 10 (median WMSI 2.03 IQR 1.38-2.75) with a median LV ejection fraction was 30.1 % IQR, median troponin level was 3083 ng/L, median BNP was 761 ng/L. Death for any cause occurred in 4 patients among patients with regional LV abnormalities and in 3 with normal regional function (p= 0,02).

Discussion A single bedside transthoracic echocardiogram performed in non critically ill COVID-19 patients with suspected cardiac injury has the potential to better assist clinicians in their challenging decision process. As an isolated increase of troponin levels is common in COVID patients, a bed-side echocardiographic evaluation of cardiac function should be routinely implemented during their early evaluation.

Background

Coronavirus disease 2019 (COVID-19) is a recognized infectious disease that has spread since December 2019, rapidly through-out Wuhan, China, to several countries around the world [1]. Cardiovascular manifestations induced by viral infection has generated considerable concern. Several case series studies have shown that a variable increase of serum troponins levels is common in COVID-19 patients [2-4]. In a not negligible proportion of them, these is associated with symptomatic acute coronary syndromes, cardiac arrhythmias and acute heart failure and lead to worse and more often fatal course of the viral disease, unlike what has been observed in COVID-19 patients with known cardiovascular disease but without troponin elevation [3;5]. In particular, the association between isolated elevated levels of troponin and a viral myocarditis or ischemic cardiac injury remains controversial as many COVID-19 patients cannot receive further cardiologic diagnostic workup (e.g. echocardiography, coronary angiography, cardiac RM). Therefore, we aimed at assessing the clinical characteristic and the prevalence of left ventricular (LV) dyssynergy patterns in a cohort of hospitalized non-critically ill COVID-19 patients with and without increase of troponin levels.

Methods

For these purpose we included consecutive patients older than 18 years, with an objective diagnosis of COVID-19-pneumonia admitted to our medical COVID Unit at the University Hospital of Padua, from February to April 2020. Baseline characteristics and comorbidities was collected. At time of the admission, in all patients an electrocardiogram and a set of lab tests, including serum troponin I and D-dimer levels were performed. In case of increased troponin levels or symptoms suggestive for a concomitant cardiac syndrome, patients undergo to serial electrocardiograms, serial Troponin tests, and bedside transthoracic echocardiogram. The left ventricular regional segmental thickening were estimated according to the ASE recommendations for use in clinical trials. Baseline characteristics, echocardiographic and biohumoral parameters were presented using descriptive statistics. Continuous variables were shown as median (IQR) and categorical variables as frequencies and percentages. Comparative analyses were performed using Fisher's exact test.

Results

Overall, we retrieved data from 402 consecutive patients. Of them, 23 were excluded because of the need for intensive care or ventilatory support at time of admission. Of the remaining 379, 55 patients (14.5%) underwent an echocardiographic exam because of an increase in troponin levels or a suspected myocardial injury. The median age was 71 years and 35 were male (63.6%). Table 1 summarized the baseline and clinical characteristic of patients. At least one cardiovascular risk factor was present in 47 patients (85.5%), in particular hypertension (67.3%), atrial fibrillation (37%) and history of coronary artery disease (25.5%). Of the 55 patients (Table 2), segmental left ventricular abnormalities were found in 10 (median WMSI 2.03 IQR 1.38-2.75) and normal regional function in the remaining 45. In patients with regional LV abnormalities, the median LV ejection fraction was 30.1 % IQR, median troponin level was 3083 ng/L, median BNP was 761 ng/L. The corresponding values for patients with normal LV regional function were 57.8 %, 620 ng/L and 376 ng/L, respectively. Electrocardiographic finding suggestive of ischemia were found in 21 subjects. 7 patients (70%) with segmental LV abnormalities and 14 with normal regional function (31%). Death for any cause occurred in 4 patients among patients with regional LV abnormalities and in 3 with normal regional function ($p= 0,02$). There were no statistically significant differences between the two groups in all other variables analysed, except for history of coronary artery disease ($p= 0,01$). None patients with LV kinetic alteration underwent coronary angiography or percutaneous coronary intervention.

Discussion

In patients with COVID-19 pneumonia, several symptoms and signs and concomitant laboratory and electrocardiographic abnormalities suggesting or mimicking an acute coronary syndrome are common. However, often suspected cases do not undergo further cardiological workup, because of the concomitant clinical severity of the COVID pneumonia and logistic difficulties in transferring to and undergo coronary angiography or CT scanning. In our study the COVID patients with suspected myocardial injury and an

abnormal regional LV function had a higher prevalence of severe LV systolic dysfunction, higher levels of troponin and other markers of heart failure and prothrombotic and inflammatory state and higher mortality risk. Furthermore, they carried out more often several cardiovascular risk factors, especially history of coronary artery disease and peripheral artery disease. These findings were in keeping with Shi et al [7] and Guo et al [5] that report similar characteristics of patients who develop myocardial injury and an increase risk of complication. Interestingly enough, in a not negligible proportion of COVID patients with suspected cardiac injury a normal LV regional function, a less severe LV pump function and a trend toward a reduced mortality were found. In addition, recently Li et al [8] reported a prognostic value of right ventricle dysfunction, providing additive predictive value of echocardiographic examination in COVID-cohort. Our results are of potential relevance as they could help identifying both patients who deserve an non deferrable cardiologic diagnostic workup and those in whom a postponed workup can be at least considered. From these brief observation, we suggest a single bedside transthoracic echocardiogram performed in non critically ill COVID-19 patients with suspected cardiac injury has the potential to better assist clinicians in their challenging decision process. As an isolated increase of troponin levels is common in COVID patients, a bed-side echocardiographic evaluation of cardiac function should be routinely implemented during their early evaluation.

Declarations

Study data and clinical information were collected and managed by medical staff using REDCap electronic data capture tools hosted at University of Padova. The study protocol was approved by the cardiovascular section of Ethics Committee on Human Research of the Padua. Verbal or written informed consent was obtained from patients surviving hospitalization. The study was performed according to the ethical guidelines of the Declaration of Helsinki (seventh revision).

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Tables

Table 1

Baseline characteristics (N=55)	
Age (years, av)	71, SD 12
Male (%)	35 (63,6%)
Caucasian	52 (96.7%)
BMI (kg/m²)	27,4 kg/m ² (av), SD 4,5
Hospitalization median (days)	16,9 days, SD 12,8 days
Symptoms at hospital admission	
Fever	47 (85.7%)
Cough	29 (51.8%)
Chest pain	17 (31.6%)
Dyspnoea	31 (57.1%)

Table 2

	Alterations (n=10)	No alterations (n=45)	<i>p-value</i>
Risk factors			
Atrial fibrillation n(%)	3 (30)	16 (38)	0,728
Coronary artery disease n (%)	6 (60)	7 (17)	0,01
Diabetes mellitus n (%)	4 (40)	10 (23)	0,428
Dyslipidaemia n (%)	4 (40)	13 (31)	0,711
Hypertension n (%)	8 (80)	26 (86)	0,462
Active smoke n (%)	2 (20)	10 (24)	1
Chronic kidney injury n (%)	2 (20)	1 (2)	0,09
Active cancer n (%)	3 (30)	7 (17)	0,382
Stroke history n(%)	2 (20)	3 (7)	0,242
Peripheral artery disease n (%)	4 (40)	6 (14)	0,084
Echocardiographic 2D findings			
Ejection fraction (%)	30.1	57.8	-
Wall motion score index	2.03	1.04	-
Regional dissinergetic segments	63.75	0	-
ECG alterations n (%) (n=21)	7 (33)	14 (67)	-
Laboratory			
Troponin I (ng)	3083 av (16-17162),	620 av (26-715)	-
Brain Natriuretic Peptide (ng)	761 av (38-1474),	376 av (10-1911)	-
D-dimer (ng)	8620 av (150-65674)	2932 av (150-36197)	-
Death n (%) (n=7)	4 (57)	3 (42)	0,019