Tissue Doppler, Speckle Tracking and Strain Imaging

Comparison of left heart echocardiographic parameters including strain in patients with COVID-19 pneumonia three months and one year after discharge

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Background: The long-term effect of a complicated course of COVID-19 on echocardiography (EchoCG) parameters, in particular on left heart, has not been sufficiently studied.

Purpose: To compare EchoCG parameters of left heart in patients with proven COVID-19 pneumonia 3 months and one year after discharge.

Methods: The patients were identified according to the data of the medical information system of the monohospital from April 2020 to July 2021 within the framework of "One-year Cardiac Follow-up of COVID-19 Pneumonia". A total of 116 men and women were included, mean age 49 ± 14.4 years, females 49.6%. During hospitalization, chest computed tomography detected mild lesions in 31.3%, moderate lesions in 33.3%, severe lesions in 29.3% and critical lesions in 6.1%. All patients underwent clinical examination including transthoracic EchoCG with 3 months ± 2 weeks and one year ± 3 weeks after discharge. All images were digitally stored and analyzed using off-line post processing with TomTec (Philips). The LV global and segmental longitudinal strain (LS) were studied in 100 individuals with satisfactory visualization quality 3 month after discharge and in 81 individuals one year after discharge.

Results: During the observation, the average body mass index of the subjects increased $(28.7 \pm 5.8 \text{ kg/m}2.3 \text{ months}$ after discharge vs 29.4 $\pm 6.1\%$ one year after discharge, p < 0.001), as well as the rate of cardiovascular diseases (67% 3 months after discharge versus 79% one year after discharge, p = 0.008). Significant dynamics of mean left heart EchoCG parameters were observed. The mean index of left atrium (LA) maximal volume decreased ($26.0 \pm 7.2 \text{ vs } 25.3 \pm 7.4$, p = 0.015), index of LA minimal volume increased ($9.9 \pm 5.4 \text{ vs } 10.8 \pm 5.6 \text{ ml/m2}$, p = 0.011). Left ventricular (LV) end-diastolic, end-systolic and stroke volume indexes decreased ($49.3 \pm 11.3 \text{ vs } 46.9 \pm 9.9 \text{ ml/m2}$, p = 0.008; $16.0 \pm 5.6 \text{ vs } 14.4 \pm 4.1 \text{ ml/m2}$, p = 0.001; $36.7 \pm 12.8 \text{ vs } 30.8 \pm 8.1 \text{ ml/m2}$, p < 0,001, respectively). The LV myocardial mass index increased (70.0 [60.8-84.0] vs 75.4 [68.2-84.9] g/m², p = 0.024). LV ejection fraction increased ($68.1 \pm 5.3 \text{ vs } 69.7 \pm 4.6\%$, p = 0.013). The LV global LS (-20.3 \pm 2.2 \text{ vs } -19.4 \pm 2.7\%, p = 0.001) and the LV segmental LS worsened: in mid segments (antero-septal -21.1 \pm 3.3 vs -20.4 \pm 4.1\%, p = 0.039; inferior -21.0 $\pm 2.7 \text{ vs } -20.0 \pm 2.9\%$, p = 0.039; lateral -18.4 $\pm 3.7 \text{ vs } -17.6 \pm 4.4\%$, p = 0.021), and in apical segments (anterior -22.3 $\pm 5.0 \text{ vs } -20.8 \pm 5.2\%$, p = 0.006; inferior -24.6 $\pm 4.9 \text{ vs } -22.7 \pm 4.6$, p = 0.003; lateral -22.7 $\pm 4.5 \text{ vs } -20.4 \pm 4.8\%$, p < 0.001; septal -25.3 $\pm 4.2 \text{ vs } -23.1 \pm 4.4\%$, p < 0.001; apical -23.7 $\pm 4.1 \text{ vs } -21.8 \pm 4.1\%$, p < 0.001).

Conclusions: Compared to 3 month after discharge, in patients one year after COVID-19 pneumonia the LA maximal volume, LV end-diastolic, end-systolic and stroke volumes decrease, and the LV ejection fraction increased. However, the LA minimal volume increased, and the LV global and segmental LS of the apical and mid LV segments worsened.