CARDIOVASCULAR FLASHLIGHT

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Acute myocarditis presenting as a reverse Tako-Tsubo syndrome in a patient with SARS-CoV-2 respiratory infection

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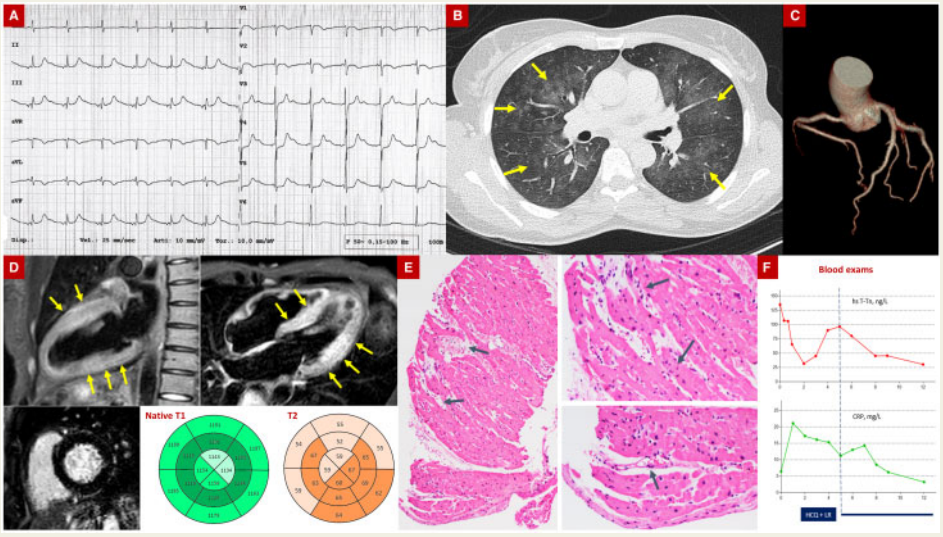

A 43-year-old woman presented to the emergency room for a 3-day history of oppressive chest pain and dyspnoea. Her past medical history was unremarkable. On admission, she had a temperature of 37.7°C, blood pressure 120/80 mmHg, and heart rate 79 b.p.m. Physical exam revealed decreased breath sounds at lung bases with ronchi. Because of oxygen desaturation (Sp_{O2} 89%), continuous positive airway pressure (CPAP) was positioned.

Chest X-ray documented subtle bilateral opacities suggesting interstitial inflammatory lung disease. In consideration of the local coronavirus epidemic outbreak, nasopharyngeal and oropharyngeal swabs were immediately obtained, confirming SARS-CoV-2 positivity.

ECG (*Panel A*) showed low atrial ectopic rhythm, mild ST-segment elevation in leads V1–V2 and aVR, reciprocal ST depression in V4–V6, and QTc 452 ms with diffuse U-waves. The high-sensitivity troponin T curve was 135–107–106 ng/L (normal value <14), NT-proBNP 512 pg/mL (normal value <153), and C-reactive protein 18 mg/L (normal value <6). Transthoracic echocardiogram showed mild left ventricular systolic dysfunction (LVEF 43%) with inferolateral wall hypokynesis; neither ventricle was dilated and there was no pericardial effusion.

Although the first clinical suspicion was myocarditis, coronary computed tomography angiography (CTA) was acquired to rule out coronary artery disease (CAD). Baseline chest scan (*Panel B*) confirmed bilateral patchy ground-glass opacities; CTA showed no aortic dissection, pulmonary embolism, or epicardial CAD (*Panel C*). Dynamic 3D volume-rendering reconstruction demonstrated a clear hypokinesia of the left ventricle mid and basal segments, with normal apical contraction, suggesting a reverse Tako-Tsubo syndrome (TTS) pattern (Supplemental material online, *Movie S1*).

The patient was admitted to a specialized COVID-19 Unit at our Institution, on droplet precautions.

Following multidisciplinary evaluation, both cardiac magnetic resonance (CMR) and endomyocardial biopsy (EMB) were planned to clarify diagnosis.

CMR (day 7) showed a recovery of systolic function (from 52% by CTA to 64% by CMR), although with persistence of a mild hypokinesia at basal and mid left ventricular segments; at the same sites, diffuse myocardial oedema, determining wall pseudo-hypertrophy, was observed on short T1 inversion recovery (STIR) sequences (*Panel D*) and confirmed by T1 and T2 mapping (average native T1 = 1188 ms, normal value <1045; average T2 = 61 ms, normal value <50). Late gadolinium enhancement sequences demonstrated absence of detectable myocardial scar/necrotic foci.

EMB (*Panel E*, day 7) documented diffuse T-lymphocytic inflammatory infiltrates (CD3+ >7/mm^2) with huge interstitial oedema and limited foci of necrosis. No replacement fibrosis was detected, suggesting an acute inflammatory process. Molecular analysis showed absence of the SARS-CoV-2 genome within the myocardium. No contraction band necrosis or TTS-associated microvascular abnormalities were observed.

The final diagnosis was acute virus-negative lymphocytic myocarditis associated with SARS-CoV-2 respiratory infection.

The patient started empirical treatment with lopinavir/ritonavir 500 mg b.i.d. and hydroxycholoroquine 200 mg b.i.d. Preserved systolic function (LVEF 65%) was maintained, ECG normalized, and both troponin T and C-reactive protein showed progressive improvement (*Panel F*). The patient was discharged with no symptoms (day 13).

The mechanisms explaining myocardial injury in patients with COVID-19 infection remain to be understood. We showed the first direct evidence of myocardial inflammation in a COVID-19 patient, undergoing both CMR and EMB characterization.

All nurses, anesthesiologists, and infectious diseases specialists working hard in our country in this difficult period are greatly acknowledged for their massive efforts and daily care for critically ill patients suffering from SARS-CoV-2 infection.

Supplementary material is available at *European Heart Journal* online.