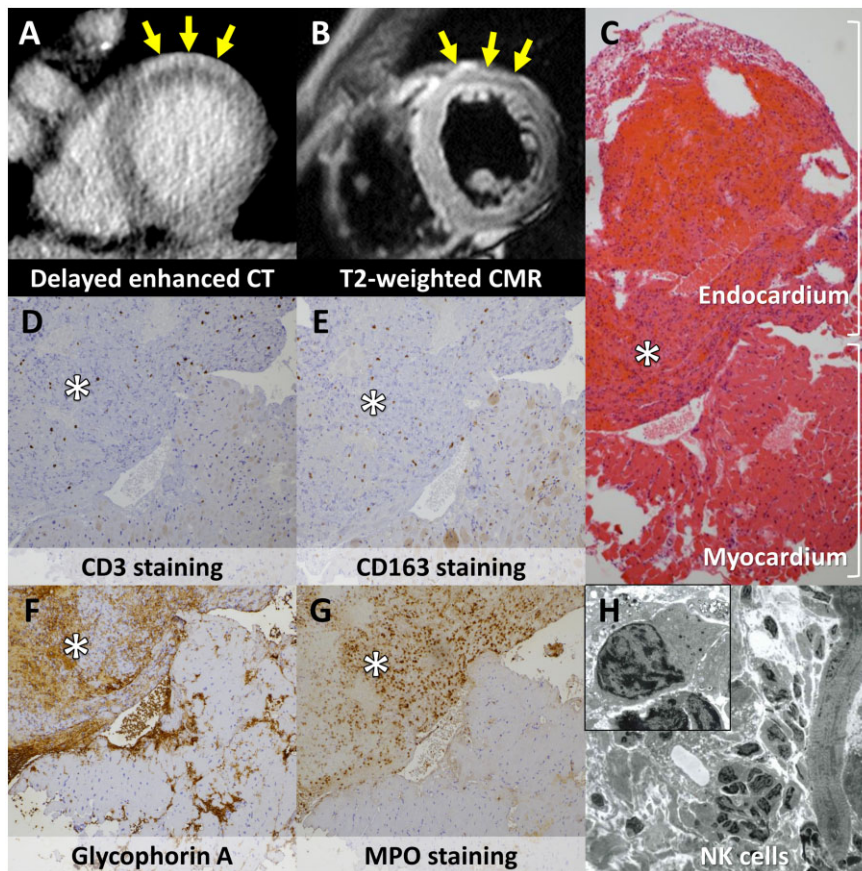


# Non-infectious endocarditis and myocarditis after COVID-19 mRNA vaccination

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**Figure 1**

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A 20-year-old previously healthy man presented to the hospital with chest pain 2 days after his 2nd dose of mRNA-1273 SARS-CoV-2 vaccination (Moderna). He had a fever of 37.5°C and his Abbott ID NOW COVID-19 test returned negative. Electrocardiography showed ST-segment elevation in leads I, aVL, and V2–6 (Supplementary material online, Figure S1). Echocardiography showed mid-anterior wall motion abnormality in the left ventricle. His troponin T level was 509 ng/L (normal range,  $\leq 14$  ng/L); his creatinine kinase level was 376 U/L (normal range, 50–210 U/L); and his C-reactive protein level was 2.40 mg/dL (normal range,  $< 0.30$  mg/dL). Coronary computed tomography (CT) angiography demonstrated no coronary abnormalities. Six minutes after contrast administration, CT showed subepicardial delayed enhancement in the left ventricular anterior wall (Panel A and Video 1), which was consistent with cardiovascular magnetic resonance imaging (Panel B and Video 2), indicating acute myocarditis. Right ventricular endomyocardial biopsy revealed a distinct endocardial thickening (Panels C–E: asterisks indicate the same point of the thickened endocardium on the sections), consisting of erythrocytes (Panel F) and myeloperoxidase-positive neutrophils (Panel G). A focal infiltration of mononuclear cells was also found in the endocardium, which were identified as natural killer (NK) cells with dense granules of about 250 nm diameter in the cytoplasm by electron microscopy (Panel H). Autoantibodies associated with connective tissue diseases were negative. His symptoms improved overnight without any treatment and he was discharged 3 days after admission. We previously reported in *European Heart*

*Journal* that non-bacterial endocarditis can develop after COVID-19 infection. Given that neutrophils and NK cells play an essential role of the innate immune responses to viral infection, maladaptive immune activation triggered by mRNA vaccination against SARS-CoV-2 might affect the myocardium, ultimately inducing endocarditis and myocarditis similarly to COVID-19 infection.

Supplementary material is available at *European Heart Journal - Case Reports* online.

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**Consent:** The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** N.O.-M. has activities as consultant for Canon Medical Systems; also, she got payment for lectures from Daiichi-Sankyo, Philips Medical Systems, Eisai, Bayer Healthcare, GE Healthcare, and Canon Medical Systems. The other authors have no financial conflict of interest.

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