



## Imaging and Case Report

# “Spontaneous” Coronary Artery Dissection After SARS-CoV-2 Messenger RNA Vaccination

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Infection by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes significant systemic inflammation, which can potentially affect heart muscles and coronaries, leading to myocarditis, arrhythmias, or myocardial infarction.<sup>1</sup> The exact mechanism of myocarditis is unknown; however, cardiac damage has been correlated with either direct viral injury or host immune response.

There are some reports that have suggested the occurrence of spontaneous coronary artery dissection (SCAD) with acute myocardial infarction after SARS-CoV-2 infection.<sup>2</sup> SCAD is defined as nontraumatic and noniatrogenic separation of the coronary arterial wall.<sup>3</sup> Hematomas formed in the false lumen can grow up to a point where they obstruct the flow in the coronary and potentially lead to myocardial infarction. So far, there has been no report regarding a possible association between SARS-CoV-2 vaccination and the occurrence of SCAD.

### Case 1

A 58-year-old female patient was admitted to the emergency department on February 2022 with severe chest pain that had started 2 hours before presentation, occurring 2 days after SARS-CoV-2 messenger RNA (mRNA) vaccination (Comirnaty; Pfizer-BioNTech). A physical examination yielded unremarkable results. The patient had the following cardiovascular risk factors: arterial hypertension and dyslipidemia. Laboratory tests showed a troponin value of 3205 ng/mL (normal value [n.v.], <12 ng/mL) and yielded positive results for inflammatory markers such as C-reactive protein (CRP) (5.4 ng/mL; normal value, <0.5 ng/mL). Echocardiography showed preserved left ventricular ejection fraction with apical and septal hypokinesia, with no significant valvular defect. The patient was brought to the catheterization laboratory, where she was diagnosed with non-ST-elevation myocardial infarction. Proximal and middle left anterior descending artery showed a plaque determining 50% tandem stenosis, with impaired flow distally (Figure 1A), whereas the other coronary segments were normal. Because of the atypical angiographic pattern of such lesions, we decided to perform intravascular ultrasound imaging, which revealed a

dissection of the left anterior descending artery into the ostioproximal segment, with an intramural hematoma (Figure 1B). Based on the SCAD European consensus document,<sup>3</sup> because the vessel was well patent and the distal flow was maintained, the patient was treated conservatively with statins and a single antiplatelet agent. The patient was discharged 2 days later and was asymptomatic. After 3 months, no further events occurred.

### Case 2

A 48-year-old female patient was admitted to our catheterization laboratory in January 2022 for a 3-day-long chest pain that occurred 4 days after SARS-CoV-2 mRNA vaccination (Comirnaty). A laboratory analysis showed mild leukocytosis (11.500/mL) and positive CRP results (13.3 ng/mL; normal value, <0.5 ng/mL). Angiography showed a diffusely narrowed distal circumflex artery (Figure 1C), with no other significant coronary artery disease. Because of suspicion of SCAD, we performed an optical coherence tomographic analysis (Supplemental Video 1) and confirmed the diagnosis based on a clear 2-lumen vessel and the absence of atherosclerotic coronary artery disease (Figure 1D). Because of the patency of the vessel, conservative management was chosen. The patient was still asymptomatic 3 months later.

### Discussion

No single case of the occurrence of SCAD after receiving SARS-CoV-2 mRNA vaccination has been reported so far. Previously, a strong relationship was well described between influenza epidemics and the occurrence of myocardial infarction,<sup>4</sup> and it is well recognized that coronary arteries may be affected by systemic inflammation associated with acute viral infections.<sup>5</sup> Vaccination has been associated with some complications, from common pain at the site of injection to fever, myalgia, headache, and rash; other more severe complications, such as myocarditis, are really rare but could lead to serious illnesses and death of the patient. An inflammatory response is common to most of the side

Keywords: COVID-19; spontaneous coronary artery dissection; vaccination; vaccination complication.

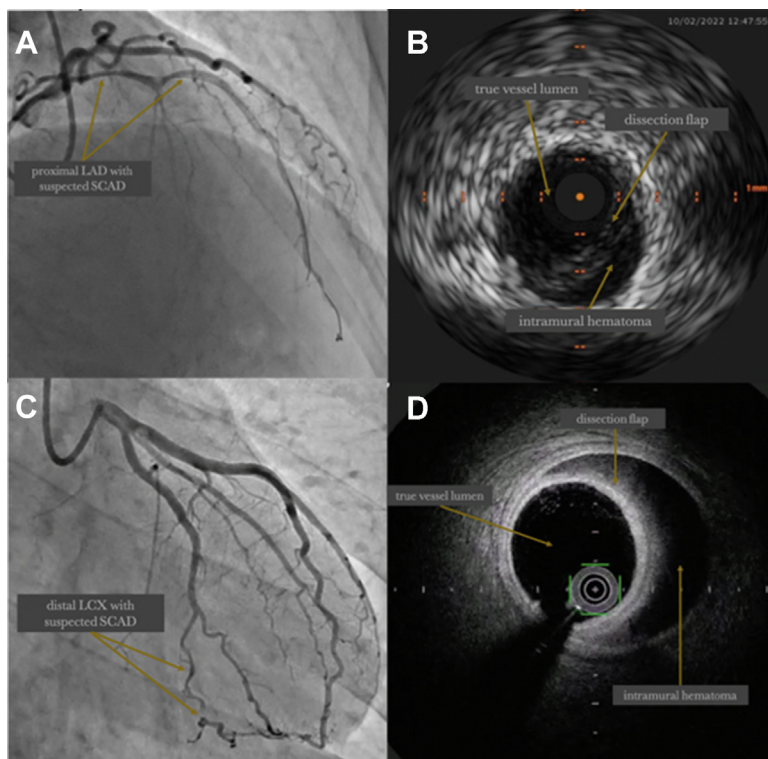
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<https://doi.org/10.1016/j.jscai.2022.100551>

Received 8 October 2022; Received in revised form 4 November 2022; Accepted 10 November 2022

Available online XX XXXX

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**Figure 1.**

(A) Coronary angiography showing stenosis in the proximal aspect of the left anterior descending artery, with suspicion of spontaneous coronary artery dissection (SCAD). (B) Intravascular ultrasound imaging of the proximal aspect of the left anterior descending artery showing a dissection flap, with an intramural hematoma. (C) Coronary angiography showing stenosis in the middistal aspect of the circumflex artery, with high suspicion of SCAD. (D) Optical coherence tomography analysis confirming the dual-lumen appearance of SCAD, with no clear sign of vessel rupture. LAD, left anterior descending artery; LCX, left circumflex artery.

effects of vaccination and is usually related to local production of cytokines and complement factors, which is sometimes followed by the release of cytokines, prostaglandins, and CRP in the blood. In some genetically predisposed individuals, the mRNA of the vaccine can trigger the exact immune response seen with the infection, resulting in systemic inflammation, thus also leading to myocarditis.<sup>6</sup> In a series of US patients treated with vaccination in whom viral myocarditis occurred, this complication was correlated with an abnormal individual immunologic response.<sup>7</sup>

The European Society of Cardiology position article on SCAD has suggested that adventitial inflammation leads to disruption of vasa vasorum, resulting in hemorrhage into the tunica media. The exact mechanism by which this vaccine could damage the arterial wall remains unknown; however, it can be argued that the mechanism is immune mediated by cytokines produced in response to the vaccine. We observed 2 cases of resting chest pain occurring few days after COVID-19 mRNA vaccination, with a possible relationship between the immunologic milieu of vaccination and disruption of the tunica intima observed. Because of the limited number of observations, we cannot claim that there is a causal effect between mRNA vaccination and the occurrence of SCAD, and we do not know whether a similar risk is present with other types of COVID-19 vaccination. According to the European Society of Cardiology position article on SCAD,<sup>3</sup> no specific intervention should be performed unless coronary flow is absent (vessel occlusion) or severely impaired; only in these cases, an interventional approach should be preferred over a conservative one. For further diagnostic purposes, intravascular imaging may be performed unless angiography shows clear signs of SCAD. In case of intravascular imaging, it should be well kept in mind that this further analysis may carry a risk of complications, often related to unclear wire positioning in the vessel lumen, and in the case of optical coherence tomography, it may carry a risk of propagation of dissection because of the required power injection. In case 2, the operator decided to perform an optical

coherence tomography analysis despite clear angiographic signs of dissection in order to evaluate the real vessel dimension, which was not clear at the time of angiography, and because intravascular ultrasound was not available in the catheterization laboratory that day. Regarding the antiplatelet regimen, the same consensus has indicated treatment with a single antiplatelet agent as the first choice in case of conservative management. No specific workup has been suggested by current guidelines with regard to other associated vascular abnormalities after SCAD diagnosis. In summary, we believe that the focus and management of SCAD potentially related to vaccination should not be different from that reserved for other forms of SCAD.

## Conclusions

These cases showed a potential correlation between SARS-CoV-2 mRNA vaccination and SCAD; however, these preliminary findings should be assessed in detail before claiming a potential causal effect.

## Learning points

- To understand one of the potential complications of SARS-CoV-2 vaccination.
- To be prepared and act promptly in case of chest pain occurring just after COVID-19 vaccination, with fast diagnosis and prevention of myocardial infarction.

## Declaration of competing interest

The authors declared no potential conflicts of interest with respect to this research, authorship, and/or publication of this article

### Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### Ethics statement and patient consent

The authors confirm that the research was performed in accordance with the appropriate ethical guidelines, and written consent for submission and publication of this case report, including images and associated text, has been obtained from the patients in line with Committee on Publication Ethics guidance.

### Supplementary material

To access the supplementary material accompanying this article, visit the online version of the *Journal of the Society for*

*Cardiovascular Angiography & Interventions* at [10.1016/j.jscai.2022.100551](https://doi.org/10.1016/j.jscai.2022.100551).

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