

CASE REPORT

Stent thrombosis during COVID-19 pandemic: A case series

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic originated from Wuhan, China, in late 2019. In addition to the respiratory system, COVID-19 also affects other organ systems. The disease can lead to cardiovascular complications such as myocarditis, acute myocardial infarction, acute heart failure, and venous thromboembolism; patients with COVID-19 experience more thrombotic events than non-COVID-19 patients. A 50-year-old male cigarette smoker presented to the emergency department (ED) with typical chest pain. His electrocardiography (ECG) showed an anterior STEMI. He developed multiple episodes of ventricular fibrillation (VF) and received defibrillator shocks. His angiogram showed thrombotic severe in-stent restenosis (ISR) of the left anterior descending (LAD) artery stents. A 70-year-old diabetic hypertensive woman presented to the ED with dyspnea and chest pain. The patient had undergone angioplasty two times beforehand, and a fresh angiogram revealed severe thrombotic ISR of LAD stents and another far midpart lesion after the stents. She underwent successful percutaneous coronary intervention (PCI). A 54-year-old man presented to the ED with typical chest pain commencing an hour beforehand. He had undergone angioplasty about 10 years earlier. The patient received the Oxford/AstraZeneca COVID-19 vaccine 36 h before developing chest pain. The ECG revealed an infero-posterior STEMI, and the angiogram depicted thrombotic occluded ISR in the RCA. The patient underwent successful PCI. Patients with COVID-19 or even with COVID-19 vaccination experience stent thrombosis due to a hypercoagulable state. Hence, we need standard guidelines to prevent stent thrombosis.

KEYWORDS

cardiovascular disease, COVID-19, in-stent restenosis

1 | BACKGROUND

In late 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged from Wuhan, China, giving rise to coronavirus disease 2019 (COVID-19). In March 2020, the World Health Organization (WHO) declared COVID-19 a

pandemic.^{1,2} Although it initially seemed that SARS-CoV-2 only affects the pulmonary system, recent studies have shown that it can also involve the cardiovascular system, gastrointestinal system, central nervous system, kidneys, and liver.³

COVID-19 can lead to various cardiovascular complications, including myocarditis, acute myocardial

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infarction, acute heart failure, and venous thromboembolism. Arrhythmias, shock, and cardiac arrest are the other fatal complications of COVID-19.⁴ Patients with COVID-19 may present with ST-elevation myocardial infarction (STEMI) as the first clinical presentation of the disease. Most of these patients have obstructive CAD. Patients with COVID-19 experience more thrombotic events than non-COVID-19 patients.^{5–8}

COVID-19 leads to a hypercoagulable state. Although different hypotheses have been proposed to explain this phenomenon, the exact mechanism remains unclear.⁹ Laboratory tests show changes in favor of the hypercoagulable state, including increased fibrinogen and factor VIII levels. The patient's condition, such as immobility and mechanical ventilation, also increases the chance of a hypercoagulable state.¹⁰

Stent thrombosis is a fatal complication of coronary artery stenting. The incidence of stent thrombosis decreases after a month of angioplasty because of complete endothelialization,¹¹ and the rate of this complication has decreased over time due to novel stent technologies and preventive methods.¹² Drug-eluting stents and double antiplatelet therapy are vital preventive measures.¹³ An alarming phenomenon observed recently is that the incidence of stent thrombosis can be up to ten times higher in COVID-19 patients than in non-COVID-19 patients.¹⁴

2 | CASE SERIES

2.1 | Case 1

A 50-year-old male cigarette smoker presented to the emergency department (ED) with the chief complaint of typical chest pain. He had a previous history of angioplasty about 6 years ago. The patient had mild COVID-19 symptoms, and the patient's real-time PCR test for COVID-19 was positive. Upon arrival, the patient developed ventricular fibrillation (VF) and received four defibrillator shocks. After five minutes, the patient developed VF again and received two further shocks.

The electrocardiography (ECG) of the patient showed ST-segment elevation in leads V1 to V4 and aVL, and ST-segment depression in leads II, III, and aVF. The patient was transferred to the cardiac catheterization laboratory for selective coronary angiography (SCA). The angiogram showed severe in-stent restenosis (ISR) in the midpart and proximal stent of the left anterior descending artery (LAD). The first diagonal artery (D1) was jailed within the LAD and had a severe ostial thrombotic lesion. There were also moderate plaques in the midpart of the left circumflex (LCX) artery and the ostio-proximal part of the

right coronary artery (RCA). The previous RCA stent was patent. Other coronary arteries were normal (Video S1).

After SCA, two wires were placed in the LAD and D1. Two rounds of pre-dilation were done at the D1 ostium. Thrombusuction was performed. The patient developed cardiac arrest and VF, converted successfully with cardiopulmonary resuscitation (CPR). The drug-eluting stent (DES) was deployed in D1, and kissing balloon inflation was performed. The LAD ISR was addressed with a drug-eluting balloon, and the ostial LAD lesion was stented with acceptable results. However, the patient re-developed asystole and unfortunately died after failing to respond to 45 minutes of CPR.

2.2 | Case 2

A 70-year-old woman known case of diabetes mellitus and hypertension presented to the ED with dyspnea and chest pain. The patient had undergone angioplasty two times beforehand; the first was about 12 years ago, and the second was roughly 5 years ago. The patient was hospitalized but refused angiography approximately 2 months earlier. She developed a fever and cough 1 week earlier, and her real-time PCR for COVID-19 returned positive.

The ECG of the patient showed T-inversions and ST depressions in leads V1-V6. Serial troponins were negative. Transthoracic echocardiography of the patient showed mild to moderate left ventricular systolic dysfunction (ejection fraction =45%) and hypokinesia of inferior and inferolateral walls. The patient was transferred to the cardiac catheterization laboratory for SCA. The angiogram showed severe thrombotic ISR of LAD stents and another far midpart lesion after the stents. The diagonal artery was jailed in a stent with a severe ostial lesion. The first obtuse marginal artery (OM1) had a mild impart lesion. The RCA had intimal irregularity at the proximal part. Other coronary arteries were normal (Video S2).

After SCA and LAD wiring, pre-dilation of the LAD was done. A DES was deployed, and post-dilation was done. Percutaneous old balloon angioplasty (POBA) of the LAD ISR was done, and another DES was deployed. Post-dilation was done successfully. The patient was discharged after recovery.

2.3 | Case 3

A 54-year-old man presented to the ED with typical chest pain commencing about an hour beforehand. The patient had a previous history of angioplasty about 10 years ago. He reported receiving the Oxford/AstraZeneca COVID-19

vaccine 36 h before developing chest pain. The ECG showed ST-segment elevations in leads II, III, aVF, and posterior leads.

The patient was transferred to the cardiac catheterization laboratory for SCA. The angiogram of the patient showed thrombotic occluded ISR in the RCA artery. The LCX artery had a moderate midpart lesion, and OM1 had a moderate ostial lesion. The LAD had chronic total occlusion at the midpart (Video S3). After SCA and RCA wiring, pre-dilation was done. After receiving eptifibatide, two DESs were deployed. The posterior descending artery (PDA) stent was pre-dilated, and POBA was done. Post-dilation was done successfully. The patient was discharged after recovery.

3 | DISCUSSION

A hypercoagulable state represents one of the most important complications of COVID-19, featuring a high incidence rate.¹⁵ Although venous thromboembolism is common in COVID-19 patients, arterial thromboembolism is less common.¹⁶ This hypercoagulable state in COVID-19 can lead to angioplasty complications such as acute in-stent thrombosis and late stent thrombosis.¹⁷ Thrombosis can even occur when patients receive dual antiplatelet and fibrinolytic therapy.^{18,19}

The first case presented to the ED with typical chest pain and VF. The ECG showed an anterior STEMI, and the angiogram revealed severe ISR of LAD. The lesion was thrombotic. COVID-19 causes STEMI in patients via an inflammatory process that leads to the rupture of coronary artery plaques. The disease can induce a cytokine storm, where pro-inflammatory factors are released by immune and non-immune cells. COVID-19 can also cause thrombosis formation by activating the coagulation cascade, leading to occlusion of the coronary artery. The cytokine storm also leads to endothelial dysfunction, further facilitating thrombosis formation.^{20–22} Our patient also developed a fatal arrhythmia. The rate of ventricular arrhythmia is about 5.9% in COVID-19 patients, and patients with myocardial injury are more prone to developing arrhythmias.²³

The second case presented to the ED with chest pain and dyspnea. The angiogram showed multiple thrombotic lesions of LAD stents. The patient had undergone PCI twice beforehand. Very late stent thrombosis is defined as thrombosis of a stent after more than a year, which is infrequent. The incidence of very late stent thrombosis is estimated between 0.4% and 0.9%. In these cases, the stents were implanted more than a year ago. Both patients had received dual antiplatelet therapy for 1 year after PCI,

in line with the guidelines. Despite the rarity of very late stent thrombosis, these patients developed this condition after SARS-CoV-2 infection. Inflammatory changes and plaque rupture are possible mechanisms.^{24–26} Another case report described a 65-year-old man who developed very late stent thrombosis in two previous stents 10 days after COVID-19 affliction.²⁷ It seems that COVID-19 increases the risk of very late stent thrombosis besides acute stent thrombosis.

There is also some evidence of thrombotic events in patients who received vaccination against COVID-19. One of the side effects of COVID-19 vaccination is arterial or venous thrombosis.²⁸ The vaccines can also lead to concomitant thrombocytopenia and thrombosis.²⁹ In our case series, the third patient developed a STEMI 36 h after receiving a COVID-19 vaccine, with the angiogram revealing thrombotic occluded ISR of the RCA artery. A case report described an 86-year-old man with a STEMI thirty minutes after COVID-19 vaccination.³⁰ COVID-19 vaccines can cause thrombotic thrombocytopenia; the immune system produces autoantibodies after vaccination, though the exact mechanism is unknown.³¹ Another case report described two patients who developed acute myocardial infarction within 24 h after COVID-19 vaccination. The angiograms of both patients were in favor of thrombotic events.³² There are no data available about the incidence of stent thrombosis or coronary artery thrombosis after COVID-19 vaccination.

4 | CONCLUSIONS

The COVID-19 pandemic has given rise to many health problems. One of the complications of COVID-19 is cardiovascular disease, which can be fatal. Hypercoagulable states in patients with COVID-19 or even with COVID-19 vaccination can lead to stent thrombosis. Despite the rarity of very late stent thrombosis, we faced patients who developed very late stent thrombosis after SARS-CoV-2 infection. Hence, it is necessary to devise standardized guidelines to prevent stent thrombosis in COVID-19 patients. Future studies should also focus on the incidence of coronary artery thrombosis and stent thrombosis after COVID-19 affliction or vaccination.

AUTHOR CONTRIBUTION

MM and AA involved in case operator and case selection. RGV performed primary writing and case selection. SAH performed editing and secondary writing. JK involved in main researcher, case operation, selection, and primary and secondary writing.

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CONFLICT OF INTEREST

None.

ETHICAL APPROVAL

The case report was approved by ethical committee of Professor Kojuri clinic.

CONSENT

All participant filled written consent for publication and for deceased patient consent was taken from his family.

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SUPPORTING INFORMATION

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