Minimally invasive treatment of left main coronary artery thrombosis in a young patient with COVID-19

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SUMMARY
COVID-19 has been associated with cardiovascular events. This case demonstrates severe left main coronary artery thrombosis with distal embolisation in a young male patient admitted with COVID-19 who developed ST-elevation myocardial infarction. The patient was treated with thrombus aspiration combined with aggressive anticoagulant treatment, which yielded complete resolution of the thrombus. Left main thrombus represents a life-threatening coronary event and is most often associated with atherosclerotic plaque rupture. In this case, however, we suspect that COVID-19-related intimal inflammation and hypercoagulopathy might be the causal mechanism of thrombus formation. Revascularisation with coronary artery bypass grafting or percutaneous coronary intervention is the standard treatment of left main thrombosis. However, due to the patient’s young age and lack of significant atherosclerotic disease burden, we used a conservative medical treatment strategy using potent antithrombotic therapy.

BACKGROUND
Acute coronary thrombus formation is associated with high mortality and morbidity. Thrombus formation in the left main coronary artery is the most threatening thrombus localisation which most often occurs in elderly patients with significant atherosclerotic disease. Revascularisation by coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) is the standard of care therapy.1 The current SARS-CoV-2 (COVID-19) global pandemic has been demonstrated to be associated with an increased incidence of thrombotic disease in infected patients.2

CASE PRESENTATION
A young man in his early 30s, with a family predisposition to ischaemic heart disease, was admitted to the department of infectious diseases due to breathlessness, fever, and severe coughing. The patient tested positive for SARS-CoV-2 RNA 3 days prior to admission. At admission, the patient was treated with oxygen, dexamethasone, remdesivir and subcutaneous dalteparin 5000 IU×1. A CT chest scan showed diffuse infiltrative ground-glass opacification with consolidation. Piperacillin/tazobactam treatment was commenced on suspicion of bacterial superinfection.

After 7 days of admission, the patient no longer required oxygen treatment and discharge was planned. However, the patient developed sudden onset of chest pain.

INVESTIGATIONS
ECG showed ST-segment elevation in the anterior leads (figure 1A) and echocardiography showed anteroapical akinesia and a left ventricular ejection fraction of approximately 50%.

The patient was transferred to the catheterisation laboratory for acute coronary angiography. Coronary angiography revealed a large ostial thrombus in the left main coronary artery (figure 1B) with embolisation to the distal left anterior descending artery. The circumflex and right coronary artery appeared normal.

TREATMENT
An intravenous bolus of unfractionated heparin and oral loading dose of aspirin was administered prior to transportation to the catheterisation laboratory. PCI with thrombus aspiration from the left anterior descending artery followed by balloon angioplasty without stenting resulted in acceptable flow (Thrombolysis In Myocardial Infarction (TIMI) flow grade 2) to the apical region. The left main coronary thrombus did not cause significant flow obstruction and was left untreated. Unfractionated heparin was administered in order to keep an Activated Clotting Time (ACT) of >250 s.

The medical therapy after PCI consisted of an intravenous infusion of eptifibatide for 4 hours together with an oral loading dose of ticagrelor in combination with subcutaneous dalteparin 10 000 IU. The following days, aspirin 75 mg, ticagrelor 90 mg two times per day and dalteparin 10 000 IU two times per day were administered, and the patient was closely monitored in the acute coronary care unit.

OUTCOME AND FOLLOW-UP
A repeat coronary angiography after 2 days showed attenuated thrombus formation (figure 1C). Dual antiplatelet therapy was continued and dalteparin was reduced to a single subcutaneous dose of 15 000 IU for the following 2 weeks, after which it was reduced to 10 000 IU/ day. The patient was discharged after 48 hours in the acute coronary care unit as he remained stable without cardiac symptoms or arrhythmias during admission.

Echocardiography with agitated saline contrast in the outpatient clinic at 2 weeks showed no signs of interatrial shunting.

After 1 month, repeat coronary angiography showed complete thrombus resolution and no angiographic signs of coronary atherosclerosis (figure 1D). Optical coherence tomography,
Case report

Due to familial predisposition to ischaemic heart disease and elevated total cholesterol of 286 mg/dL (7.4 mmol/L) and low-density lipoprotein (LDL) cholesterol of 182 mg/dL (4.7 mmol/L), a follow-up examination with evaluation of cholesterol levels in first-degree relatives and genetic testing was performed. The tests did not meet the diagnostic criteria for familial hypercholesterolaemia. However, an elevated Lp(a) level was noted and atorvastatin was supplemented with ezetimibe.

Standard examination for thrombophilia (including tests for protein C, protein S, antiphospholipid syndrome, antithrombin, prothrombin, beta2-glycoprotein and factor V Leiden mutation) was negative.

The patient was followed up in the outpatient clinic after 12 months. He was feeling well with no symptoms. LDL cholesterol level was reduced to 34.8 mg/dL (0.9 mmol/L).

DISCUSSION

An increased incidence of both venous and arterial thrombotic events has been reported in patients with ongoing COVID-19 infection. Proinflammatory cytokines and endothelial dysfunction caused by COVID-19 may in part explain the increased incidence of acute myocardial infarction, and patients with high cholesterol levels may in particular be at risk. Our patient did not suffer from significant atherosclerotic disease in the index coronary angiogram, and follow-up examination with optical coherence tomography did not show evidence of high-risk plaque morphology or rupture as the causal mechanism of left main thrombus formation.

Left main coronary artery thrombosis is an uncommon condition usually associated with a poor outcome. The therapeutic options are mainly CABG or PCI. Our patient was in his early 30s and angiography did not reveal a large atherosclerotic disease burden. We therefore chose an alternative and more conservative treatment approach using balloon angioplasty with thrombus aspiration of the embolic occlusion distal in the left anterior descending artery combined with an aggressive anti-thrombotic treatment without PCI treatment of the left main artery but no intimal disruption, plaque ulceration or thin cap plaque morphology (figure 1E).

Dalteparin treatment was stopped and dual antiplatelet treatment was planned for a total of 12 months.

Cardiac MRI with gadolinium contrast was consistent with transmural acute myocardial infarction in the left main coronary artery but no intimal disruption, plaque ulceration or thin cap plaque morphology (figure 1E). Dalteparin treatment was stopped and dual antiplatelet treatment was planned for a total of 12 months.

Systemic inflammation with COVID-19 may lead to an increased risk of acute myocardial infarction.

COVID-19 may be associated with a large coronary thrombus burden.

Antithrombotic treatment with potent antiplatelet therapy and high therapeutic doses of low-molecular-weight heparin may constitute an alternative to percutaneous coronary intervention or coronary artery bypass grafting in left main coronary thrombosis in selected patients.
involved in the planning of this case report. JJ and NBS wrote the initial manuscript draft. JJ was involved in the initial diagnosis and treatment. NBS and SDK performed the angiographies and decided on the selected treatment strategy.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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**REFERENCES**