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## Mechanical complications of myocardial infarction during COVID-19 pandemic: An Italian single-centre experience

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### ABSTRACT

COVID-19 pandemic triggered in many patients the fear to go to the emergency rooms in order to avoid a possible infection. This phenomenon caused a significant reduction in acute coronary syndrome-related interventional procedures with a subsequent increase in critical hospitalizations and post-infarction mechanical complications. A case series of cardiac ruptures during the COVID-19 lockdown and the surgical treatment of a huge post-ischemic cardiac pseudoaneurysm complicated by a “contained” free wall rupture are presented.

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### Introduction

COVID-19 pandemic completely overturned the common therapeutic and diagnostic mechanisms of the health care. The large widespread of the infection and the great overload of the intensive care units made the hospital as possible contagion areas, so it triggered in many patients the fear to go to the emergency rooms.<sup>1</sup> This especially hit the cardiologists patients that demonstrated to avoid the hospital even in case of acute coronary syndrome (ACS) symptoms. Many authors showed that in the lockdown period there was a reduction of about 37% in ACS-related interventional procedures compared to the same period of the 2019.<sup>2</sup> Piccolo et al. found that percutaneous coronary interventions (PCI) rates decreased from 190 to 120/100,000 residents while from 107 to 66 and from 84 to 54 for Non-ST-Elevation ACSs (NSTEMI-ACS) and ST-elevation myocardial infarctions (STEMI) respectively. Despite the indications of the Italian Society of Interventional Cardiology (GISE) recommended to predilect endovascular treatment of ACSs during the COVID-19 period,<sup>3</sup> this phenomenon created a big population of patients that entered the hospital with mechanical complications of an evolving ACS. This had completely thwarted the prevention strategies based on the earliness of revascularization and brought back to “life” a lot of cardiologists conditions that had not been seen for many years. During the last 4 months, indeed, we experienced a lot of ACS-related mechanical complications in a very higher rate compared to the last 10 years. Here are reported five meaningful and interesting cases observed

from February to May 2020 that came to our observation with a cardiac rupture caused by a delayed ACS treatment.

### Case presentation

A 58-years old woman came to our observation from the emergency department with diagnosis of subacute left ventricular (LV) free wall rupture to be surgically treated. The patient was previously hospitalized in December 2019 due to an ST-elevated ACS caused by sudden occlusion of the left anterior descending (LAD) coronary artery and she was treated with double percutaneous transluminal coronary angioplasty (PTCA) and stenting. Her medical history highlighted very high cardiovascular risk: type II diabetes mellitus, 2<sup>nd</sup> grade obesity (BMI=37kg/m<sup>2</sup>), dyslipidaemia, hypertension and smoke addition. On May 2020 she was admitted to the hospital because she experimented mild effort dyspnoea and tachycardia, so she was referred to the Cardiology department. Serum analysis and ECG were negative for a new ACS, but the echocardiogram revealed the presence of a huge dilatation of the cardiac apex (6.5 cm x 5.2 cm) complicated by subacute rupture of its posterior wall and by organized thrombosis inside it (Fig. 1A). Mild pericardial effusion was present therefore, because of these findings and a serum haemoglobin of 5 mg/dl, an Angio-CT scan was performed. The presence of a pseudoaneurysm of the posterior cardiac apex and a “contained” rupture of its wall (Fig. 1B) was confirmed so she was moved to our cardiac surgery department. It's important to underline that the patient was treated for her ACS in the “pre-COVID-19” era with the standardized therapeutic approach and within the recommended times. Thus, a mechanical complication and/or apical aneurysm was unexpected. The echocardiogram performed at the previous discharge, indeed,

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**Fig. 1.** (A) Angio-CT scan showing the LV and the posterior apex pseudoaneurysm with parietal thrombus and wall discontinuity. (B) Preoperative transoesophageal echocardiogram.

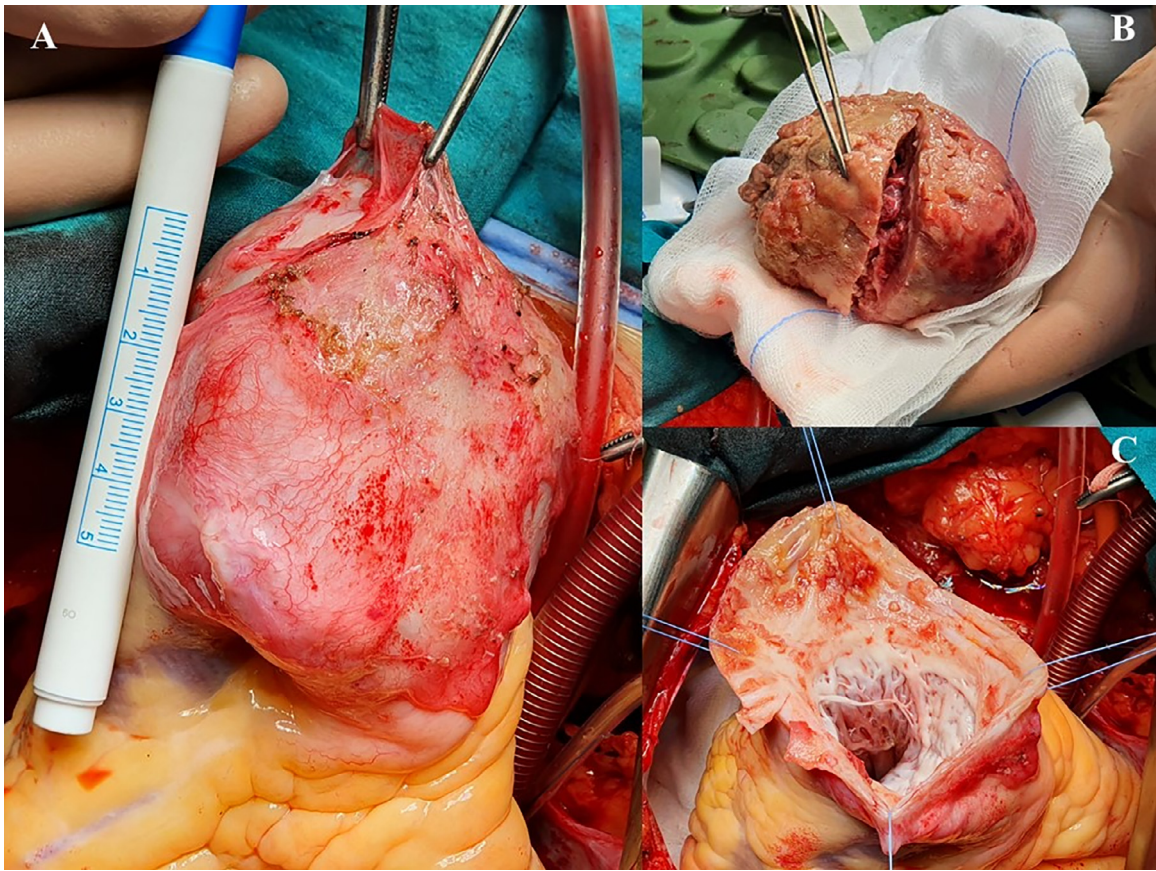
didn't revealed any significant depression of the apical systolic function able to justify this cardiac lesion. Going through the patient's medical history in the SARS-CoV-2 related lockdown period, we found that in March she experimented for 3 days a "strange" dyspnoea and fatigue, but she didn't go to the hospital because she was worried to get SARS-CoV-2 infection relying on home remedies. We can hypothesize that the patient experimented a new occlusion of the LAD leading to apex necrosis and the subsequent dilatation and rupture. According to the institutional protocol, she was listed for urgent surgery with standard anaesthesia and surgical approaches for adult cardiac surgery. A median sternotomy was performed and cardiopulmonary bypass (CPB) was started through aortic and bicaval cannulation. Pericardium was widely opened only after the CPB started in order to prevent any rupture of the aneurysm. External examination revealed a huge dilatation of the cardiac apex (Fig. 2A) with well-organized thrombus inside it (Fig. 2B) and contained rupture of the free wall (Fig. 2C). Because preoperative transoesophageal echocardiogram showed an adequate distance of the lesion from the mitral valve, it was decided to repair the heart using a composite patch according to the modified Jatene's technique. The myocardial hole was previously reduced using a 3-0 polypropylene purse string and then repaired using Dacron and bovine pericardium patches like

a "sandwich" (Fig. 3A). It was decided to place the Dacron patch inside, in contact with blood, in order to better support to the ventricular wall and in order to prevent calcification of the bovine pericardium. The aneurysmatic wall above the patch was then closed with Teflon stripes and 3-0 polypropylene running suture in order to reconstruct the cardiac apex according to the Dor's technique (Fig. 3B). Postoperative echocardiogram revealed a perfect restoring of the ventricular shape (Fig. 3C) with an end-diastolic LV volume of 86 ml, a very good pump function and no need of inotropic support. In-hospital course was uneventful, and the patient was discharged 6 days after the operation.

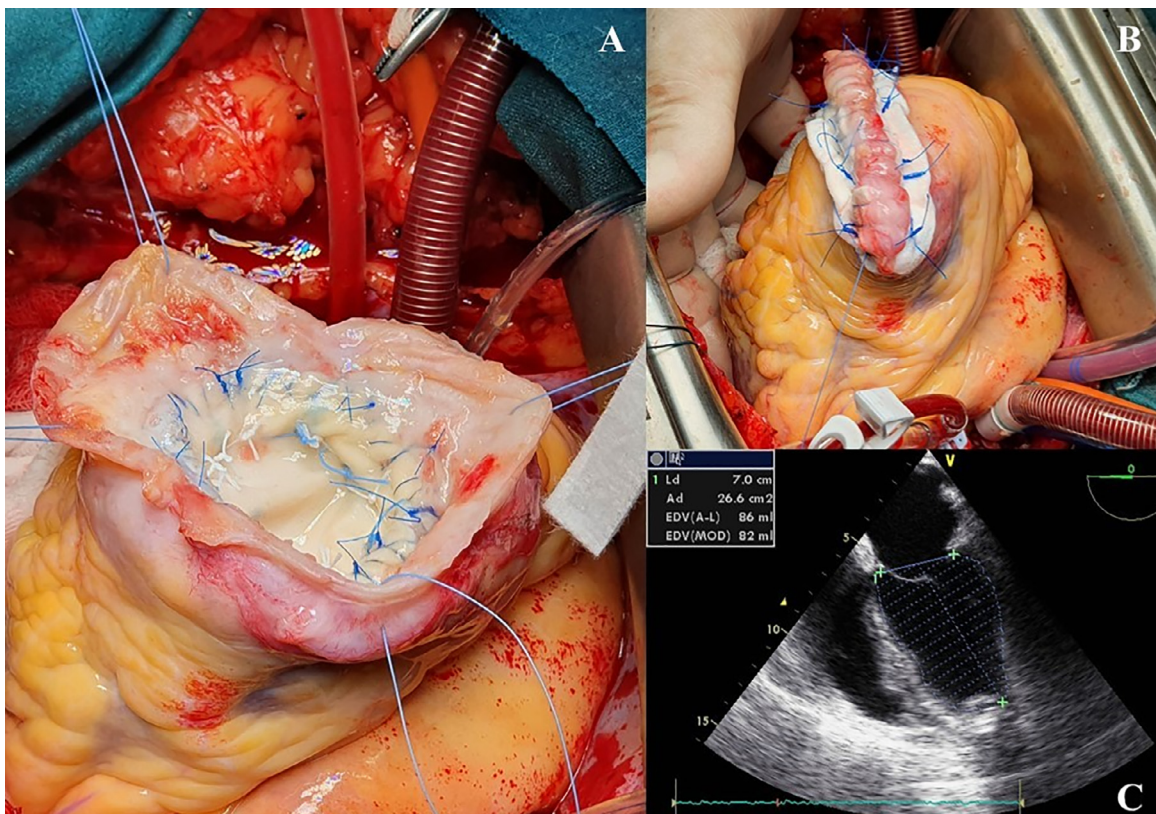
At 2-months follow-up, the patient is in very good general state and restarted her normal personal and work life.

## Discussion

Left ventricular free-wall rupture (LVFWR) represents a life-threatening condition that has gradually disappeared thanks to the great improvement in PCI techniques and to the earliness of treatments. Today, it affects about 2% of patients with acute myocardial infarction<sup>4</sup> but, due to COVID-19 pandemic, mechanical complications of ACSs are probably destined to increase. Although many



**Fig. 2.** (A) Intraoperative view of apex dilatation. (B) Organized thrombus removed from the left chamber. (C) Opened pseudoaneurysm showing the transition between necrotic scar and vital muscle.



**Fig. 3.** (A) Surgical reconstruction of the cardiac apex and (B) final result. (C) Postoperative echocardiogram showing restore of the LV chamber and volumes.

authors reported a mean incidence of LVFWR of about 1 case per year, we observed 5 very similar cases in only 2 months. In all patients, the cardiac rupture was caused by a delayed revascularization treatment of a single-vessel disease because all patients decided to rely home to not risk going into contact with SARS-CoV-2 in the hospital. Mean age was 54.8 years old, demonstrating that this type of complications usually affects young people, with no collateral circulations and with single massive and sudden coronary occlusion. These patients, indeed, are more suitable to develop acute mechanical injuries because the better baseline pump function and the young age allow them to survive to the infarction and to develop the complications. Among these 5 patients, with no evidences of SARS-CoV-2 infection, surgical treatment was performed only in the reported case because in the other four, according to the cardiologists, a watchful waiting behaviour was chosen. All patients had mild dyspnoea and moderate pericardial effusion without hemodynamic instability. Pericardial drainage was placed only in one patient, who was previously under aspirin treatment for primary prevention, because of increasing in pericardial effusion during the hospital stay. In this case, as well as in another one, revascularization treatment was unnecessary. Two patients underwent PTCA with stenting after the stabilization of the pericardial effusion. All patients were discharged in very good general state but this report, in our opinion, demonstrated and confirmed two key points of the ACS treatment: early coronary revascularization reduces significantly the incidence of the mechanical complication but COVID-19 pandemic could completely thwart these prevention

strategies and change the cardiac surgery population that we will have to deal with in the next months.<sup>5</sup>

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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