ESC European Society of Cardiology

European Heart Journal - Case Reports (2021) **5**(7), 1–7
doi:10.1093/ehjcr/ytab253

CASE REPORT
Classical case report

Myocardial rupture and left ventricular pseudoaneurysm due to late STEMI presentation during the COVID-19 pandemic lockdown: a classical case report

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Received 13 December 2020; first decision 2 March 2021; accepted 10 June 2021

Background Left ventricular (LV) pseudoaneurysm is a serious and rare complication of myocardial infarction (MI). It occurs when an injured myocardial wall ruptures and is contained by overlying adherent pericardium or scar tissue, most commonly it develops in patients with late presentation of MI and delayed revascularization.

Case summary A 64-year-old man presented to the emergency department with intermittent central chest pain radiating to back and neck and increasing on deep inspiration, which was considered to be of musculoskeletal origin for a week, but worsened despite medications. Electrocardiography showed features of ST-elevation MI; a circumflex artery occlusion was found on coronary angiogram and angioplasty was performed. Cardiovascular magnetic resonance (CMR) revealed features of healed lateral wall rupture with adherent parietal pericardium and the patient was managed conservatively. Two months later the patient returned with severe chest pain; echocardiogram and cardiac computed tomography showed significant interval progression of the pseudoaneurysm. Aneurysmectomy was performed, after which the patient recovered and had none of the previous symptoms since. Follow-up CMR study revealed improvement of LV systolic function.

Discussion A rare case of post-infarction LV pseudoaneurysm was reported. Multimodality imaging helped to detect and to differentiate this complication from the true aneurysm and to follow it up and plan the treatment. Conservative treatment was not effective in this case as the pseudoaneurysm progressed; aneurysmectomy helped to improve LV systolic function.

Keywords Pseudoaneurysm • Myocardial infarction • Complication • Multimodality imaging • Case report

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Handling Editor: Tom De Potter
Peer-reviewers: Jan Henzel and Grigoris Karamisis
Compliance Editor: Brett Sydney Bernstein
Supplementary Material Editor: Anthony Paulo Sunjaya

Learning points

- Left ventricular (LV) pseudoaneurysm is a myocardial wall rupture contained by overlying adherent pericardium, pericardial adhesions, thrombus, and/or scar tissue. It is a rare complication of myocardial infarction (MI) with the incidence of 0.2–0.3%, although can occur after trauma, cardiac surgery, or infective endocarditis.
- Multimodality imaging helps to diagnose a pseudoaneurysm in the setting of late presentation of MI, and to differentiate a pseudoaneurysm from a true aneurysm, which has all layers of the myocardium and vessels.
- Untreated pseudoaneurysm has a high risk of rupture with a reported incidence of 30–45% due to the tendency to grow fast. Surgery is the first-line treatment for large and symptomatic LV pseudoaneurysms.

Introduction

Left ventricular (LV) pseudoaneurysm is a serious complication of myocardial infarction (MI), requiring rapid diagnosis and management.[1] It is a rare entity nowadays with a reported incidence of 0.2–0.3%, which has been decreasing in recent decades due to advancements in timely revascularization and medical therapy.[1] However, during a pandemic such as the coronavirus disease 19 caused by SARS-CoV-2, the number of rare of MI complications such as pseudoaneurysms or post-MI pericarditis may increase due to reduced healthcare service accessibility, reduced admissions of patients with acute coronary syndrome,[2] and late presentations of acute coronary syndromes. It has been reported that public avoidance of hospital contact due to fear of contracting SARS-CoV-2 infection leads to a delay in the timely presentation of MI patients.[3] Therefore, despite the historical decline in late presentation-related MI complications, it is important to be familiar with them.[3]

Timeline

1 week before admission	Chest pain, treated as musculoskeletal
Clinical presentation and imaging work-up at admission	Intermittent central chest pain radiating to back and neck, increasing on deep inspiration, and becoming more severe a day before admission Electrocardiography (ECG): SR, ST elevation in II, III, V5, V6 leads, suggestive of a lateral ST-elevation myocardial infarction (MI) Coronary angiogram: occluded circumflex artery; angioplasty performed Cardiovascular magnetic resonance (CMR): a healed rupture of the left ventricular (LV) lateral wall with a transmural infarction and microvascular obstruction, adherent parietal pericardium, and pericardial inflammation Conservative treatment
2 months after admission	Severe chest pain ECG: features of a previous lateral MI Echocardiography: features of a pseudoaneurysm Computed tomography: large LV pseudoaneurysm. Patent stent in the left circumflex
9 weeks after admission	Aneurysmectomy
4 months after admission	Follow-up CMR study: LV systolic function improvement

Case presentation

A 64-year-old man with a medical history of Type II diabetes, hypothyroidism, hyperlipidaemia, and obesity (body mass index 35 kg/m^2) and family history of ischaemic heart disease presented to the emergency department during the first nation-wide UK lockdown with intermittent central chest pain radiating to back and neck, increasing on deep inspiration. The intermittent pain had lasted for a week and was previously treated as musculoskeletal, but tended to worsen and became severe overnight prior to the admission day despite paracetamol. Physical examination was unremarkable apart from fine left-sided crackles. Haematological and biochemical analyses revealed thrombocythemia (430 $\times$ 10^9/L, normal range 150–400 $\times$ 10^9/L) and increased blood urea nitrogen levels (8.8 mmol/L, normal range 2.5–7.8 mmol/L), creatine kinase myocardial band was normal (4 µg/L, normal value <5 µg/L). Electrocardiography (ECG) showed sinus rhythm and ST elevation in II, III, V5, and V6 leads (*Figure 1*), suggestive of lateral MI. Chest radiograph revealed a prominent left cardiac silhouette (*Figure 2A*). In view of worsening chest pain, severe for <48 h and associated with ST elevation typical of MI, primary percutaneous coronary intervention was indicated and performed. This showed occlusion of the left circumflex (LCx) artery; a drug-eluting stent was inserted (*Videos 1 and 2*). Cardiovascular magnetic resonance (CMR) imaging was performed to assess the LV function and to characterize the myocardium. This revealed moderate to severe LV systolic dysfunction (LVSD) with an ejection fraction of 42% due to a subacute full-thickness infarct of the lateral wall with microvascular obstruction and oedema of the infarcted region. Epicardial contour of the basal lateral wall was slightly altered, suggesting a healed contained rupture with adherent parietal pericardium; there were features of pericardial inflammation with suspicion of early constriction (*Figure 3*, *Video 3*, and Supplementary material online, *Video S1*). A diagnosis of late presentation posterolateral ST-elevation myocardial infarction

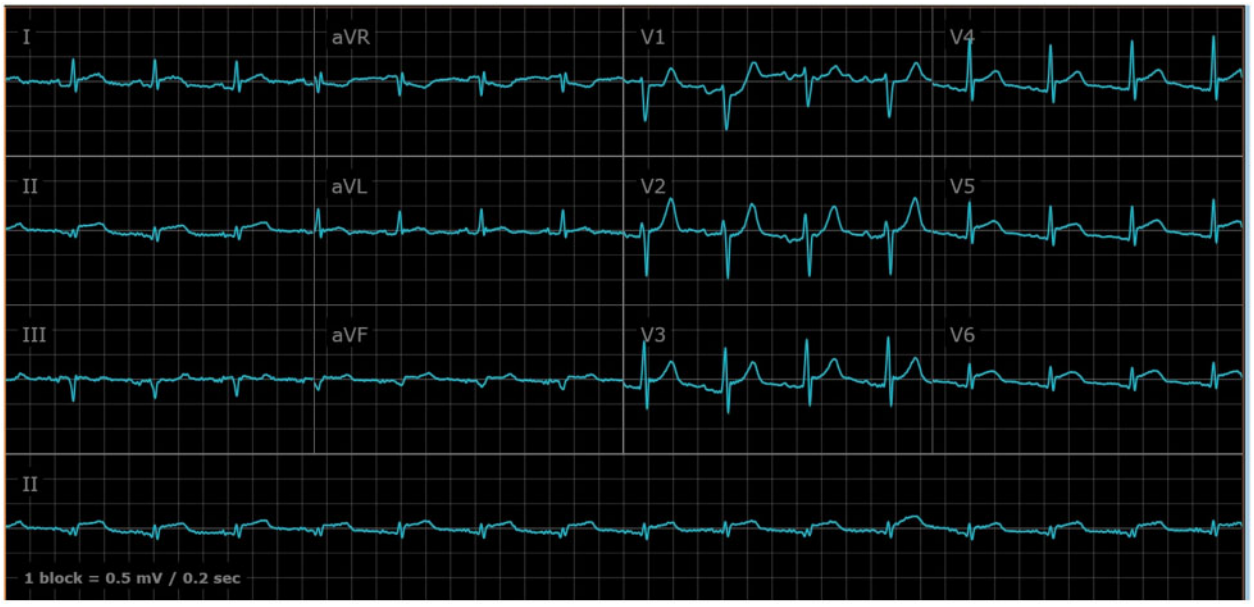


Figure 1 Electrocardiogram on admission suggestive of a lateral ST-elevation myocardial infarction.

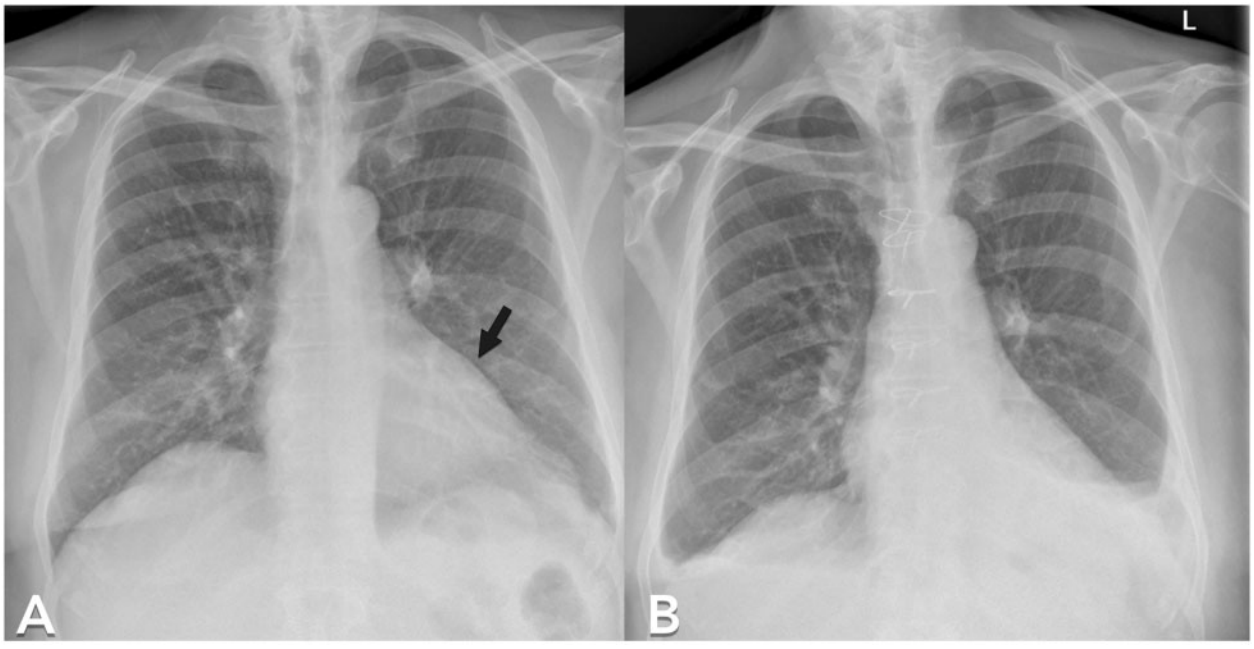
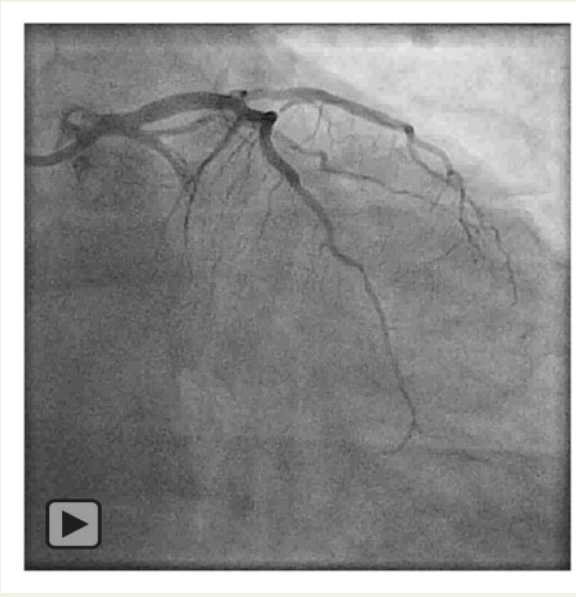
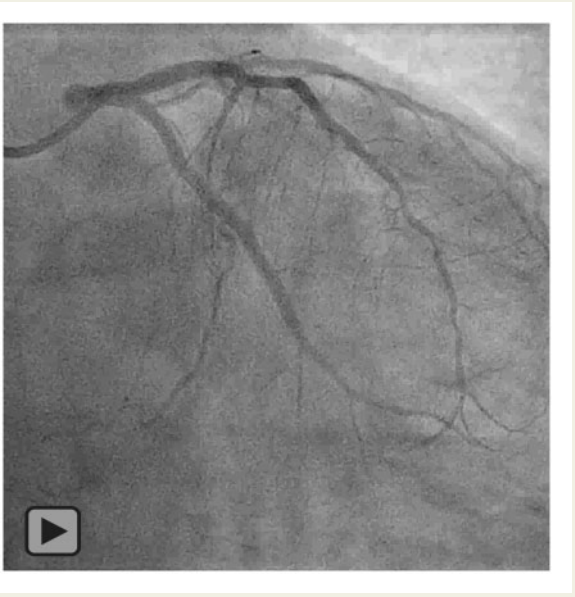


Figure 2 Posteroanterior chest radiographs. (*A*) On the first admission, showing a prominent left cardiac silhouette (arrow) and (*B*) 9 weeks later, post-surgery: the left cardiac silhouette has normalized; small bilateral pleural effusions and atelectatic change in the left base were expected findings immediately after surgery.

complicated by contained LV rupture and pseudoaneurysm with secondary pericardial inflammation was made. The patient was treated conservatively. Two months later, the patient returned to the hospital with severe chest pain, ECG showed evidence of previous lateral MI (Supplementary material online, *Figure S1*) and echocardiogram (*Figure 4*) showed significant interval progression of the pseudoaneurysm. An ECG-gated cardiac computed tomography (CT) study was performed to define the pseudoaneurysm and to assess the patency of the stent. This revealed a large pseudoaneurysm (8.7 cm × 4.8 cm with a neck measuring 5.5 cm × 6.2 cm in diameters) due to the



Video 1 Coronary angiography. Occluded left circumflex artery.



Video 2 Coronary angiography. Stented left circumflex and reperfusion of the vessel.

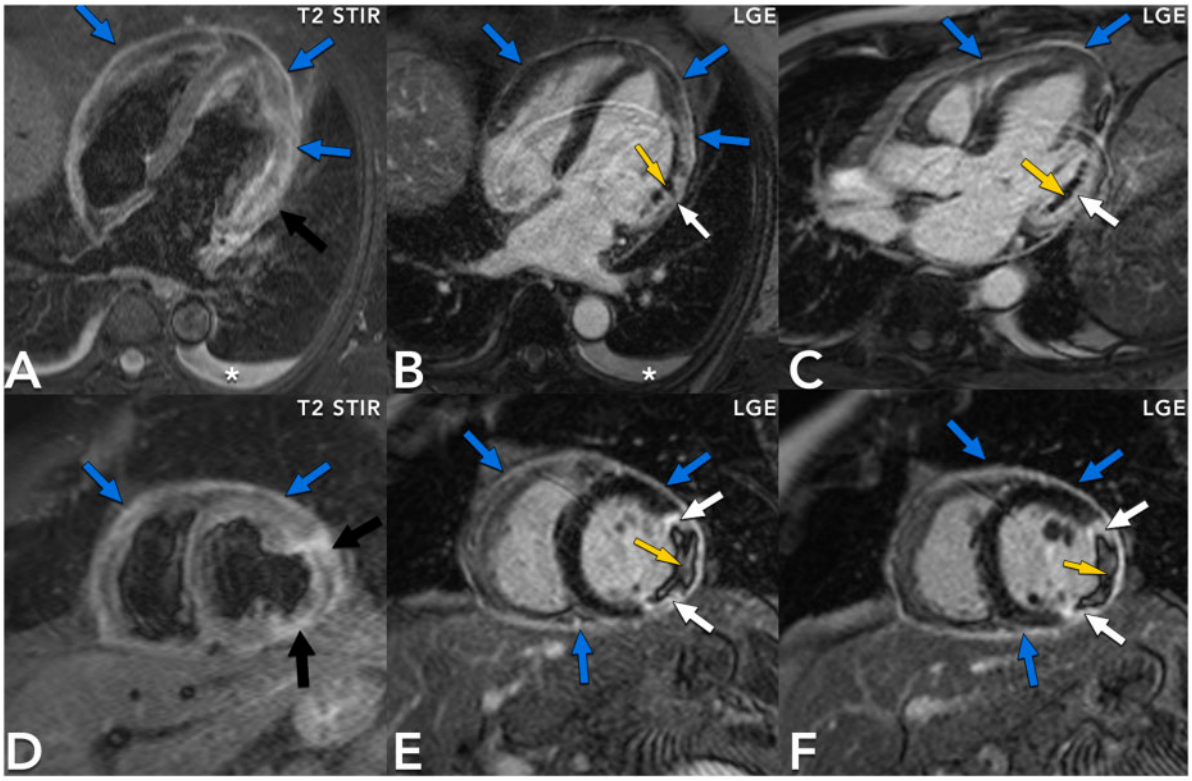


Figure 3 Cardiovascular magnetic resonance study. T2 short tau inversion recovery sequences in four-chamber (*A*) and mid-cavity level short-axis view (*D*) show oedema in the lateral wall (black arrow); the mid-wall hypointense signal within the area of oedema corresponds to the microvascular obstruction/intramyocardial haemorrhage. The pericardium is of high signal intensity suggestive of inflammation (blue arrows). Inversion recovery late gadolinium enhancement images in four-chamber (*B*), three-chamber (*C*), and mid-cavity level short-axis views (*E* and *F*) show transmural myocardial enhancement in the lateral wall (white arrows) with an area of microvascular obstruction (yellow arrows) and diffuse pericardial enhancement (blue arrows). The asterisk indicates a small left pleural effusion. LGE, late gadolinium enhancement; STIR, short tau inversion recovery.

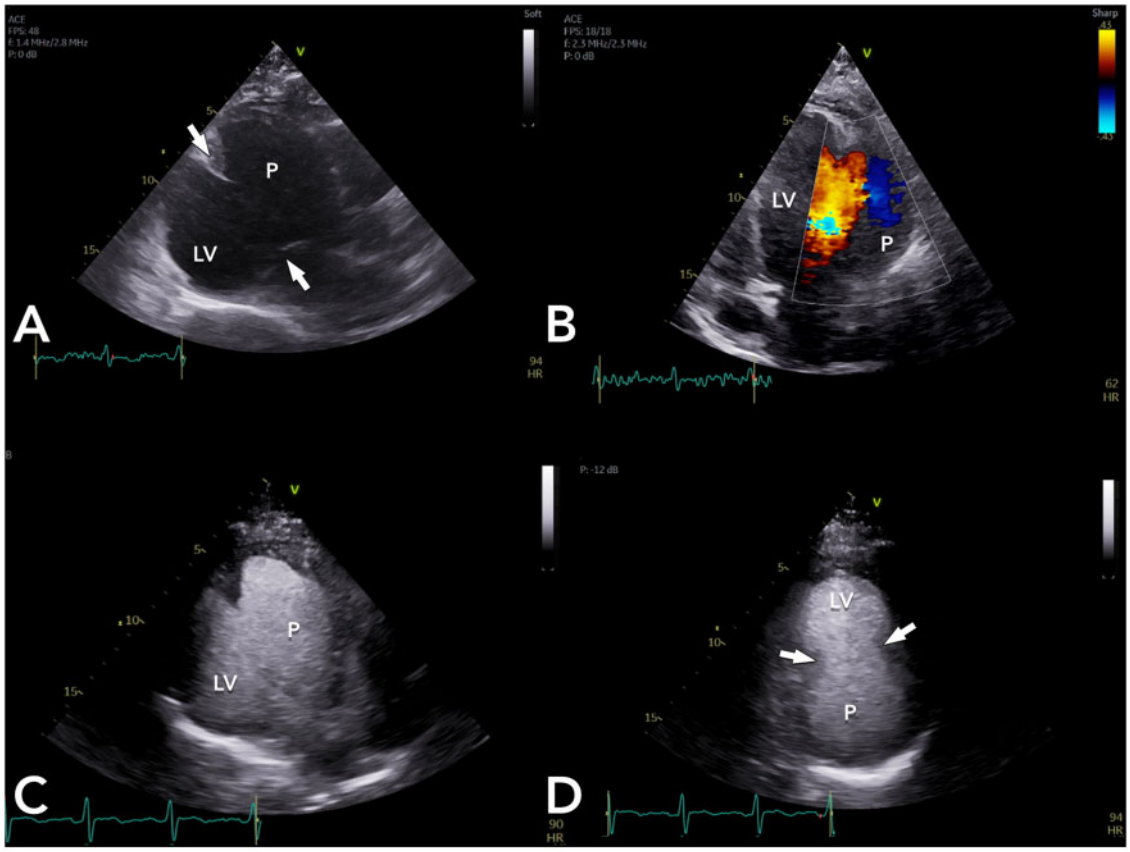
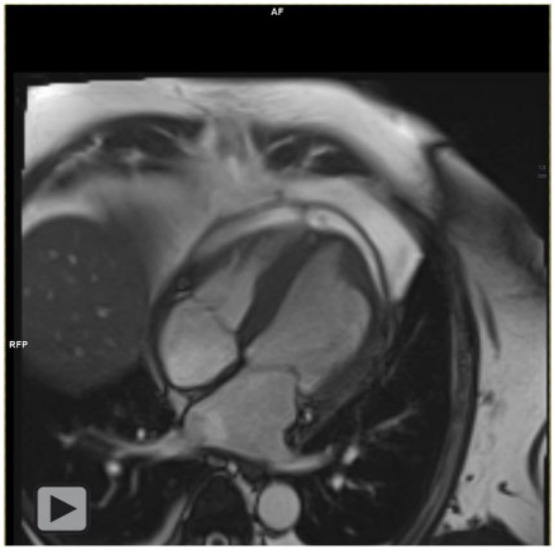


Figure 4 Transthoracic echocardiogram without (*A* and *B*) and with contrast (*C* and *D*) show a left ventricular wall defect (arrows) with a large pseudoaneurysm and turbulent systolic flow on colour Doppler (*B*). LV, left ventricle; P, pseudoaneurysm.



Video 3 Baseline cardiovascular magnetic resonance study. Steady-state free precession cine sequence in four-chamber view. Moderate to severe left ventricular systolic dysfunction, akinetic lateral wall, and a left ventricular pseudoaneurysm.

contained rupture of the LV inferolateral wall between the papillary muscles; the LCx stent was patent with only a trivial run-off distal to the stent due to MI in the corresponding territory (*Figure 5*). Aneurysmectomy was performed 9 weeks after the first admission. A week after the surgery, an echocardiogram showed mildly reduced LV function. The patient denied any chest pain or breathlessness during recovery and was discharged. Follow-up CMR study 4 months after the initial admission revealed a chronic lateral MI, repaired LV aneurysm with a small amount of retained thrombus at the site of the repair, mild LVSD, and mild to moderate mitral regurgitation (Supplementary material online, *Figure S2* and *Videos S2 and S3*). The LV systolic function had improved since the first CMR study from 42% to 55%, and the patient reported no further symptoms.

Discussion

LV pseudoaneurysm is a rare complication that usually happens when a weak part of the myocardial wall ruptures and is contained by overlying adherent pericardium, pericardial adhesions, thrombus, or scar tissue.[1,4] As a result, a narrow opening forms in the ventricular wall connecting the potential space beneath the pericardium to the ventricular cavity with blood flow through the opening.[4]

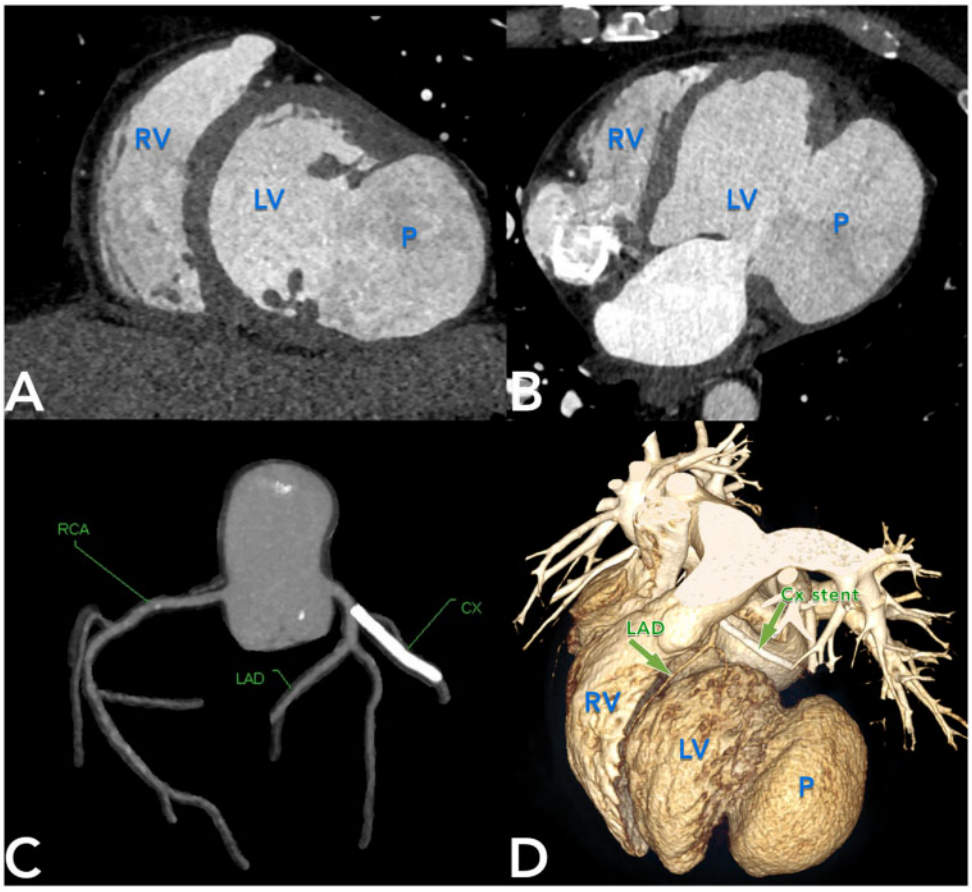


Figure 5 Electrocardiography-gated cardiac computed tomography angiogram with multiplanar (*A* and *B*), maximum intensity projection (*C*), and volume-rendered three-dimensional (*D*) reconstructions. There is a large pseudoaneurysm in the lateral wall (*A*, *B*, and *D*) and a stent in the circumflex artery (*C* and *D*). Cx: circumflex artery; LAD: left anterior descending artery, LV: left ventricle; P: pseudoaneurysm; RCA: right coronary artery; RV: right ventricle.

The most common cause of an LV pseudoaneurysm is MI, although it can occur after a traumatic injury, cardiac surgery, or infective endocarditis.[1] A pseudoaneurysm usually presents within 2 months after MI, although the interval between the index event and the diagnosis of pseudoaneurysm ranges between 1 month and 11 months.[1,5] Typically, it forms in the inferior and inferolateral walls.[1]

Older age, female sex, hypertension, poor collateral circulation, late presentation of MI, late fibrinolysis, and delayed revascularization are the main risk factors for the development of this complication.[1,6]

The most common symptoms are chest pain, congestive heart failure, arrhythmia, and dyspnoea, however, they are non-specific and >10% of patients may be asymptomatic.[1,3] A murmur is detected in ~70% of the cases on physical examination and the majority of the patients have non-specific ST changes on ECG, while only ~20% have ST-segment elevation as in our case.[1]

Multimodality imaging is essential for the diagnosis and management of LV pseudoaneurysm as it helps to plan the treatment and also to distinguish a pseudoaneurysm from a true aneurysm.[5] Unlike pseudoaneurysm, a true aneurysm involves all layers of the wall and is described as an area of thinned and dyskinetic myocardium.[5] Moreover, a true aneurysm contains myocardial remnants in its wall and coronary arteries can be traced, whereas a pseudoaneurysm has an avascular wall.[7] Echocardiography is commonly the first-line imaging method to diagnose LV pseudoaneurysm.[1] Pseudoaneurysms usually have a narrow neck and wide apex on echocardiography, while in true aneurysms, the neck is the largest part.[4,7] Contrast administration and three-dimensional echocardiography increase the ability to diagnose pseudoaneurysm; colour Doppler can show turbulent bidirectional flow at the neck of a cavity or within it.[1,5] In more than a half of the patients, LV pseudoaneurysm may appear as a mass on chest radiograph, whereas fast and good visualization of the ventricular structure and coronary arteries can be obtained by cardiac CT angiography.[1] Cardiac magnetic resonance imaging helps differentiate LV pseudoaneurysms from true aneurysms with a reported sensitivity of 100%.[4] It also allows to visualize the entire heart, evaluate viability, chamber size, and function and to characterize the tissues in detail.[5]

Untreated LV pseudoaneurysms carry a significant risk of non-contained rupture due to a tendency to grow fast with a reported incidence of 30–45%, therefore, a timely diagnosis is vital in such

patients.[1,4] Conservative treatment may be considered in asymptomatic patients with small (<3 cm) pseudoaneurysms, although patients treated conservatively have a poor prognosis with a 2-year mortality of almost 50%, therefore, surgery is commonly the first-line choice.[1,4,8] Usually, surgical treatment is recommended in symptomatic patients with large pseudoaneurysms and when the risk of fatal rupture outweighs the risk of surgery.[4,5] Post-operative mortality ranges from 13% to 29%.[8] In our case, as the pseudoaneurysm was small and contained at first, the patient was managed conservatively and underwent surgery 9 weeks later due to a significant increase of the pseudoaneurysm and symptom development.

Conclusion

Although LV pseudoaneurysm is considered a rare complication of MI, in a global pandemic of highly infectious disease, multiple factors, including decreased access to health services or fear of contracting infection may lead to late presentations of acute coronary syndromes and increased incidence of LV pseudoaneurysms. Multimodality imaging helps to differentiate a pseudoaneurysm from a true aneurysm and to plan the treatment. Due to the high risk of rupture, surgery is the first-line treatment for large and symptomatic pseudoaneurysms.

Lead author biography

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Supplementary material

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

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

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: None declared.

Funding: None declared.

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