CASE REPORT

# Left Ventricular Free Wall Rupture After Acute Myocardial Reinfarction Due to In-Stent Thrombosis in COVID-19 Patient

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**ABSTRACT**

**Background:** Acute left ventricular free wall rupture (LVFWR) is a life-threatening complication of myocardial infarction that requires urgent intervention. Surgical repair has continued to be the treatment of choice. Studies suggest a posterolateral or inferior infarction is more likely to result in free wall rupture than an anterior infarction. LVFWR generally results in death within minutes of the onset of recurrent chest pain, and on average was associated with a median survival time of 8 hours. Prompt diagnosis and management can lead to successful treatment for LVFWR. **Objective:** The aim of this article was to present an emergency case with an LVFWR in a COVID-19 patient who suffers from AMI and was treated with PCI stents in the ramus intermedius and circumflex coronary artery. **Case report:** We present an emergency case with an LVFWR in a COVID-19 patient who suffers from AMI and was treated with PCI stents in the ramus intermedius and circumflex coronary artery. Although dual antiplatelet therapy introduction and good outcome of PCI were achieved, soon after instant thrombosis of both stents appear to result in transmural necrosis and LVFWR. Urgent catheterization was performed and diagnosed in-stent thrombosis where the ventriculography confirmed LVFWR of the posteroinferior wall. Urgent surgery was performed. Transmural necrosis was noticed alongside the incision line. The incision is sawn with 4 U-stitches (Prolen 2.0 with Teflon buttressed stitches). Another layer of fixation was made by Prolen 2.0 running stitches reinforced with Teflon felts from both sides. A large PTFE patch was fixed to epicardium over the suture line by Prolen 6.0 running stitch and BioGlue was injected in-between patch and LV (Figures 8 and 9). After aortic cross-clamp removal, the sinus rhythm was restored. **Conclusion:** Despite the high mortality, the urgency and the complexity of surgical treatment the early diagnosis plays a key role in the management of postinfarction LVFWR patients presenting a case of preserved postoperative left ventricular function and accomplished good functional status, as presented in our case.

**Keywords: left ventricular free wall rupture, acute myocardial infarction, COVID-19.**

## 1. BACKGROUND

Acute left ventricular free wall rupture (LVFWR) is a life-threatening complication of myocardial infarction that requires urgent intervention. This potentially fatal event occurs in up to 2% of patients with acute myocardial infarction (AMI) (1,2,3,4). Although few methods are developed until the present time, surgical repair has undoubtedly continued to be the treatment of choice (1). The history of the introduction of the LVFWR after myocardial infarction into clinical recognition and practice is well known (2). The peak incidence of postinfarction left ventricular free wall rupture occurred at a median of five days after infarction (4). An increased number of ventricular ruptures occurring at earlier times, as early as hours after the onset of infarction appears to be a consequence of early thrombolysis and coronary reperfusion (5). Among different opinions, some studies suggest a posterolateral or inferior infarction is more likely to result in free wall rupture than an anterior infarction (6). LVFWR generally results in death within minutes of the onset of recurrent chest pain,

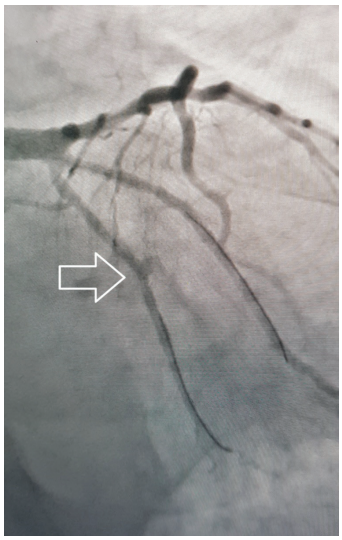

Figure 1. Complete reopening of both arteries involved in acute myocardial infarction. PCI stent in Cx and ramus intermedius.

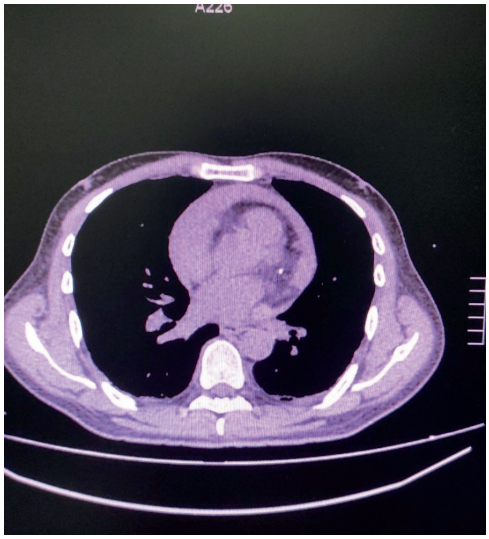

Figure 2. CTA of extravasation of blood and LVFWR with pericardial effusion

and on average was associated with a median survival time of 8 hours (2). However, prompt diagnosis and management can lead to successful treatment for LVFWR, but in-hospital mortality continues to be high (7,8). How to diagnose and successfully manage the patient in the acute phase is well established (1,2), and it is mandatory to perform the recommended procedure as fast as possible for the patient to reach surgery, with no hesitation and delay (9).

## 2. OBJECTIVE

In this article, we present an emergency case with an LVFWR in a COVID-19 patient who suffers from AMI and was treated with PCI stents in the ramus intermedius and circumflex coronary artery. Although dual antiplatelet therapy introduction and good outcome of PCI were achieved, soon after instant thrombosis of both stents appear to result in transmural necrosis and LVFWR, raising the question of could COVID-19 have an impact on the course of the event?

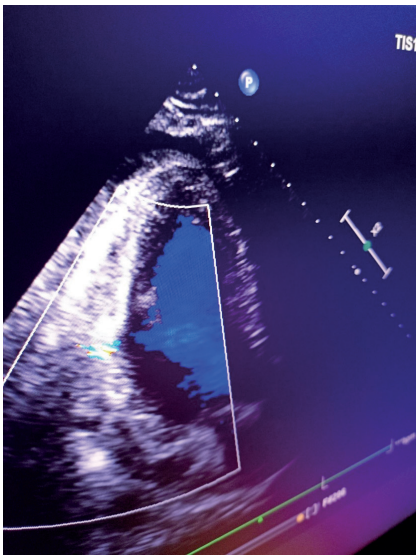

Figure 3. TTE of extravasation of blood and LVFWR with pericardial effusion

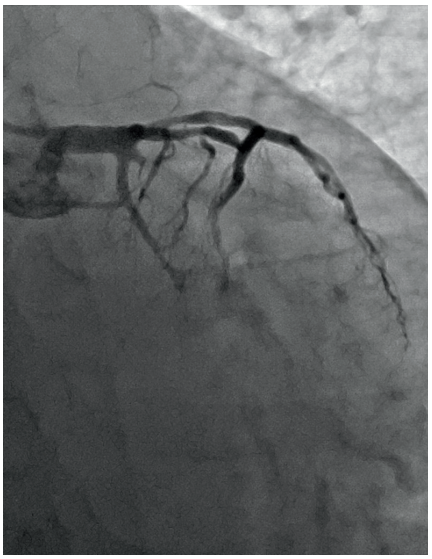

Figure 4. In-stent thrombosis after acute myocardial reinfarction

## 3. CASE REPORT

A 51-year-old man was admitted to the Cardiology Department for severe retrosternal chest pain accompanied by dyspnea and sweating. He was hemodynamically unstable with low arterial blood pressure, tachycardia and on inotropic support. The ECG recording signs of micro voltage, and ST-segment depression.

Five days previously the patient was admitted to the Interventional Cardiology Department with similar symptoms and clinical signs of AMI, with ST-segment depression, and biohumoral markers typical for AMI. Emergency catheterization was done and culprit lesions were noticed at the ramus intermedius and circumflex coronary artery. During the PCI DES stents were placed in the ramus intermedius and circumflex artery. The acquired result was excellent with the complete reopening of both arteries involved (Figure 1). Control transthoracic echocardiography (TTE) showed satisfactory left ventricular function with moderate ejection fraction (EF) and no signs of pericardial effusion. Laboratory findings revealed an increase in Troponin, MB creatine kinase and creatine kinase. Dual antiplatelet therapy was introduced and the patient was discharged to his basic medical institution for further recovery. During recovery, he suffered COVID-19 and was transferred to the Infectology Department. Several days after he presented symptoms of a new acute coronary event. Due to suspicion of acute aortic dissection computed tomography angiography was done, and a 14mm wide pericardial effusion was noticed. Part of the inferior wall of the left ventricle showed to be hypodense in the arterial and venous phase. At the inferior left ventricle wall extravasation of blood from LV was notified which pointed out an LVFWR (Figure 2). The patient was urgently transferred to the Cardiac Surgery Department in Sarajevo where TEE confirmed the LV free wall rupture and a significant reduction of EF (Figure 3.)

Urgent catheterization was performed and has diagnosed in-stent thrombosis (Figure 4) where the ventriculography confirmed LVFWR of the posteroinferior wall (Figure 5). Urgent surgery was performed. Femoral cannulation and venous cannula insertion were done under the control of TEE. After the establishment of extracorporeal circulation (ECC) the heart was decompressed, a median sternotomy, as well as pericardial upper pericardiotomy (above ascending aorta), was done, to avoid bleeding and air bubbles sucking into the heart through

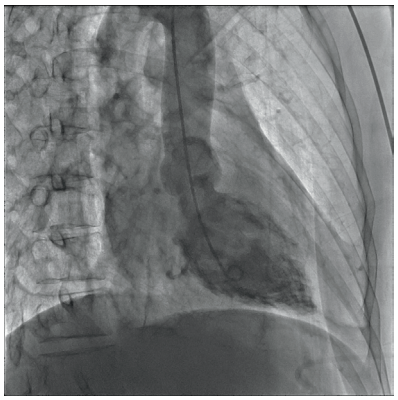

Figure 5. LVFWR of posterior wall confirmed by ventriculography

Figure 6. Pericardial clot cast removed

## 4. DISCUSSION

In this case report, we present a male patient urgently admitted to the Cardiovascular Surgery Department for treatment of LVFWR after myocardial reinfarction and urgent PCI procedure verifying in-stent thrombosis and ventriculography confirming a rupture in the posteroinferior position of the LVFW.

LVFWR is a life-threatening complication of myocardial infarction that requires urgent intervention. Since William Harvey 1647. described the first known case of postinfarction LVFWR, the incidence varies from 0.5% to 6.2% although more recent studies suggest that the incidence remains underestimated (1,2,10). The diagnosis of LVFWR can be made by several imaging techniques such as echocardiography, computed tomography angiography, ventriculography and rarely magnetic resonance imaging possible in hemodynamic stable patients. The primary diagnostic method for postinfarction LVFWR is the TTE which highly raises the suspicion of LVFWR in presence of most relevant findings like pericardial effusion in combination with cardiac tamponade symptomatology, LV wall thickness with a reduction in LVEF requiring inotropic support or the presence of epicardial clots. The echocardiographic findings of pericardial effusion were correlation to angiographic findings of pericardial effusion and a hypodense inferior LV wall in the arterial and venous phase which could be following postinfarction ischemia (Figures 2 and 3). Contrast ventriculography is valuable in establishing the definitive diagnosis and the localization of LVFWR and may help in addition to coronary angiography in planning the LVFWR. Intraoperatively were detected blood clots were cast around both ventricles, causing cardiac tamponade. The aortic cross-clamp was placed on the distal part of ascending aorta, and cardioplegic arrest, after Del Nido cardioplegia was given, has been established. The clot cast was removed (Figure 6). LVFWR was spotted at the inferior wall as an ovoid field of transmural necrosis and a ruptured spot in the middle (Figure 7). The branches of the CX artery with a diameter less than 1.0mm were inappropriate for grafting and bypass grafting attempts were cancelled. LVFWR was approached. To avoid necrotic area dimensions of 3x2cm, in the inferior free wall of LV, parallel to the left ventricle septum, closer to the basal line, LV was opened with a 4cm incision. Transmural necrosis was noticed alongside the incision line. The incision is sawn with 4 U-stitches (Prolen 2.0 with Teflon buttressed stitches), with large bites (2cm from the necrotic edge), and then reapproximated. Another layer of fixation was made by Prolen 2.0 running stitches reinforced with Teflon felts from both sides. A large PTFE patch was fixed to epicardium over the suture line by Prolen 6.0 running stitch and BioGlue was injected in-between patch and LV (Figures 8 and 9). After aortic cross-clamp removal, the sinus rhythm was restored. No bleeding was noticed at the reconstructed segment of LV. After reperfusion, the patient was weaned of CPB hemodynamically stable on minimal inotropic support. After protaminisation, decannulation and thoracic drains insertion the chest was closed in standard fashion, and the patient was transferred to the intensive care unit.

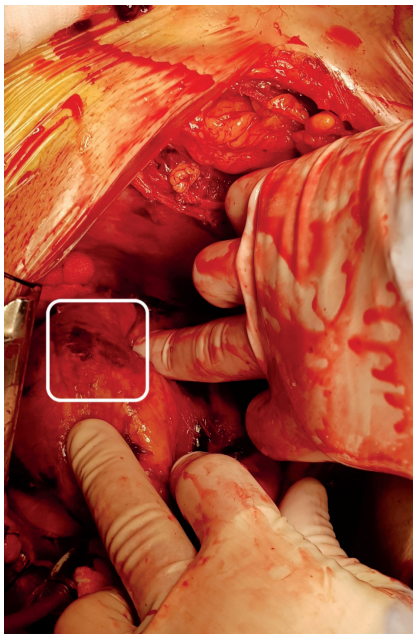

Figure 7. LVFWR at the inferior wall and an ovoid field of transmural necrosis and a ruptured spot in the middle

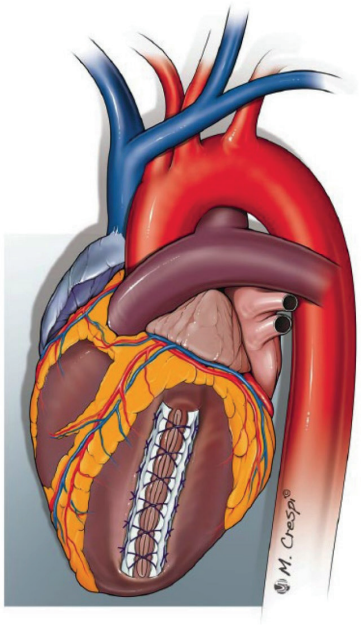


Figure 8. Schematic view of LVFWR closure reinforced with Teflon felts from both sides

The early postoperative period went uneventful. The inotropic support was reduced gradually while the troponin levels decreased and the patient was on the 5th postoperative day discharged to the ward. The patient was discharged from the hospital overall recovered on the 10th postoperative day with the control TTE that showed moderate EF, no signs of pericardial effusion and mild mitral regurgitation.

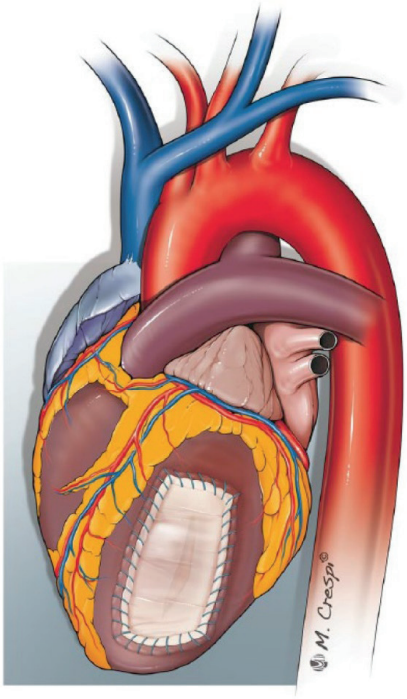


**Figure 9. A large PTEE patch fixed to epicardium over the suture line**

surgical treatment (Figure 5) (10).

LVFWR is usually associated with a transmural large anterior infarction, but several studies suggest that the posterolateral or inferior infarction more frequently results in a free wall rupture than in other locations (8-10).

Clinical presentations of LVFWR vary. The traditional classification divides LVFWR into two types, the acute type presenting with acute tamponade with electromechanical dissociation or severe hypotension and the subacute type or" oozing" type presenting mainly with pericardial effusion signs and symptoms (11,12). According to the type of presentation, tauthor'sors *Gong and Nie* introduced in their study, a new classification of LVFWR into the most common cardiac arrest type, the unstable type and the less frequent stable type (10). In the case of patients presenting hemodynamic instability even the suspicion of LVFWR after myocardial infarction is an indication for urgent surgical treatment for survival. The sutured surgical technique on ECC is the worldwide most accepted approach as reported in the meta-analysis of *Matteucci et al.* (13). Median sternotomy is the surgical approach of choice with the rapid institution of cardiopulmonary bypass (CPB) in the majority of cases. The femoral vessel cannulation preferably TEE guided to prevent further bleeding offers a safe approach to CPB, as performed in this patient. As often pericardiotomy can quickly result in massive hemorrhage that may be difficult to manage until CPB is established. In the case of this patient, a cast of blood clots rounding the ventricles was intraoperatively detected, while it has probably guarded and prevented further progression of LVFWR and massive bleeding (Figure 6.).

While acute rupture is considered to be fatal and catastrophic, a subacute form develops gradually from an incomplete rupture of the infarcted area leading to hemopericardium with or without features of cardiac tamponade. Often a thrombus in the myocardial channels communicating to the pericardial sac prevents future FWR (9,10). Several exceptional cases of LVFWR such as the posterior wall rupture, mitral regurgitation, ventricular septal rupture or a graftable coronary disease have reported beneficial short-term results for repairing LVFWR without CPB and aortic cross-clamping concerning the risk of embolic neurological complications. The *Matteucci et al.,* the study reported only 27% of LVFWR patients had a concomitant CABG during LVFWR repair (13). The small diameter of less than 1 mm of the circumflex coronary artery branches disables the possibility to find targets for coronary artery bypass grafting in this patient with potential coagulation disorders causing in-stent thrombosis potentially associated with the thrombogenicity of COVID-19, although further diagnostic laboratory studies should be performed to prove the probability (14,15).

The CPB facilitate the sutured technique surgical approach to LVFWR offering a motionless operating field while manipulating friable myocardial tissue during LV opening by avoiding a necrotic infarction area in the LV inferior wall with signs of transmural necrosis along with incision line afterwards stitching and performing incision re-approximation (Figure 7). In intention to prevent further bleeding from the suture line the technique of PTFE patch in combination with biological glue (BioGlue) was applicated (Figures 8 and 9).

Several studies showed higher survival rates by using the biological glue and patch surgical technique on CPB in patients with acstillsubacute LVFWR while some studies stistill report the increased postoperative need for IABP to achieve hemodynamic stabilization or even an operative mortality rate of 50% (10). Nevertheless, LVFWR remains the second leading cause of in-hospital death in the setting of acute myocardial infarction. Despite the high mortality, urgency, and complexity of surgical treatment, early diagnosis plays a key role in managing postinfarction LVFWR patients presenting a case of preserved postoperative left ventricular function and accomplished good functional status, as presented in our case (11,12,16).

## 5. CONCLUSION

Acute left ventricular free wall rupture (LVFWR) is a life-threatening complication of myocardial infarction that requires urgent intervention. Although few methods are developed until the present time, surgical repair has undoubtedly continued to be the treatment of choice. The CPB facilitate the sutured technique surgical approach to LVFWR offering a motionless operating field while manipulating friable myocardial tissue during LV opening. In intention to prevent further bleeding from the suture line, the technique of PTFE patch in combination with biological glue (BioGlue) is recommended. Early diagnosis plays a key role in managing postinfarction LVFWR patients and preserving postoperative LV function and accomplishing good functional status, as presented in our case.

- **Patient Consent Form:** The authors certify that they have obtained all appropriate patient consent forms.
- **Author's contribution:** A.K., I.HK, E.K, S.G, S.S. E.B.A.K., B.B. M.D. N.G and gave substantial contributions to the conception or design of the work in acquisition, analysis, or interpretation of data for the work. A.K, S.G.. had a part in article preparing for drafting or revising it critically for important intellectual content. A.K, N.G. S.G., and .gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- **Conflicts of interest:** There are no conflicts of interest.
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