JACC: CASE REPORTS VOL. 4, NO. 12, 2022

MINI-FOCUS ISSUE: PROCEDURAL COMPLICATIONS

ADVANCED

CASE REPORT: CLINICAL CASE

Acute Myocardial Infarction After Surgical Closure of Coronary Artery Fistula

Importance of Anticoagulant Therapy

Liping Meng, MD, PhD, Peng Zhang, MD, Fang Peng, MD, Ping Wang, MD

ABSTRACT

We present a case of a coronary arteriovenous fistula between the left circumflex (LCX) and the atrium with LCX ectasia. Four months after surgical closure of the fistula, the patient experienced acute myocardial infarction caused by thrombosis in the LCX. Antiplatelet drugs were replaced with anticoagulant agents, and the patient was followed up without adverse events. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2022;4:738–741) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 60-year-old woman with repeated chest tightness after exertion for 2 years was referred to our hospital. Her vital signs were as follows: body temperature, 36.7 °C; heart rate, 74 beats/min; respiratory rate, 19 breaths/min; and blood pressure, 135/89 mm Hg. Physical examination revealed no obvious abnormalities.

LEARNING OBJECTIVES

- To understand that patients undergoing surgical closure of the CAF with TIMI flow grade 3can be treated with antiplatelet therapy, whereas patients with TIMI flow grade 2 should be treated with anticoagulant therapy and a single antiplatelet agent.
- To recognize that anticoagulant therapy may be a better choice for patients undergoing surgical closure of the CAF with a higher risk (large and distal fistula, dilated coronary artery, TIMI flow grade 2) for coronary thrombosis.

MEDICAL HISTORY

The patient had a 5-year history of hypertension, which was controlled well with amlodipine.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis included coronary artery disease, gastritis, and valvular heart disease.

INVESTIGATIONS

Echocardiography showed an enlarged left atrium (42 mm) with an ejection fraction of 63% and no valvular regurgitation. The patient initially received a diagnosis of coronary heart disease and underwent coronary angiography without stress testing. As shown in **Figure 1** and Video 1, the LCX was thick and

From the Department of Cardiology, Shaoxing People's Hospital, Shaoxing Hospital, Zhejiang University School of Medicine, Shaoxing, China.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received April 13, 2022; accepted April 25, 2022.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2022.04.012

the vascular wall was dilated. The distal LCX was twisted and drained into the right atrium. Three-dimensional enhanced CT of the heart also showed a fistula between the LCX and the right atrium with LCX ectasia (**Figure 1**). The fistula between the LCX and the right atrium was too large for transcatheter occlusion. Therefore, the patient underwent surgical closure of the fistula. After surgery, she was prescribed daily oral antiplatelet drugs, and her chest tightness was subsequently relieved.

MANAGEMENT

Four months after surgical closure of the fistula, the patient experienced sudden thoracalgia in the chest and was referred to our hospital immediately. Electrocardiography showed Q waves in the II to III and avF leads, with slight elevation of the ST-segment (**Figure 2**). The troponin level was 25.92 mg/mL (normal <0.1 mg/mL). The patient received a diagnosis of non-ST-segment elevation myocardial infarction and underwent emergency digital subtraction angiography. As shown in **Figure 3** and Video 2, thrombosis was noted in the dilated LCX, and the fistula between the LCX and the right atrium was closed. Intravascular thrombus aspiration was performed; however, no thrombus was aspirated. Because the LCX was not occlusive and had TIMI (Thrombolysis In Myocardial Infarction) flow grade 2, surgery was terminated, and the patient was admitted back to the cardiac care unit without percutaneous coronary intervention. After surgical closure of the coronary artery fistula, daily oral antiplatelet drugs were administered, and the LCX was largely dilated with TIMI flow grade 2, which was thought to be the cause of the thrombosis. We considered the use of anticoagulants to replace antiplatelet drugs for the prevention of coronary thrombosis. After discharge, the patient was prescribed rivaroxaban (20 mg/day) without antiplatelet drugs. Two months later, repeated coronary angiography showed no thrombosis or stenosis in the LCX (**Figure 4,** Video 3). Subsequently, the patient was prescribed rivaroxaban 20 mg daily and was followed up uneventfully for 1 year.

DISCUSSION

Coronary arteriovenous fistula (CAF) is a congenital coronary artery anomaly found in approximately 0.9% of the adult population. Patients with CAF can experience symptoms depending on the type of fistula and presence of collateral circulation. Exertional dyspnea and angina pectoris due to myocardial ischemia or endocardial fibrosis are the predominant

ABBREVIATIONS AND ACRONYMS

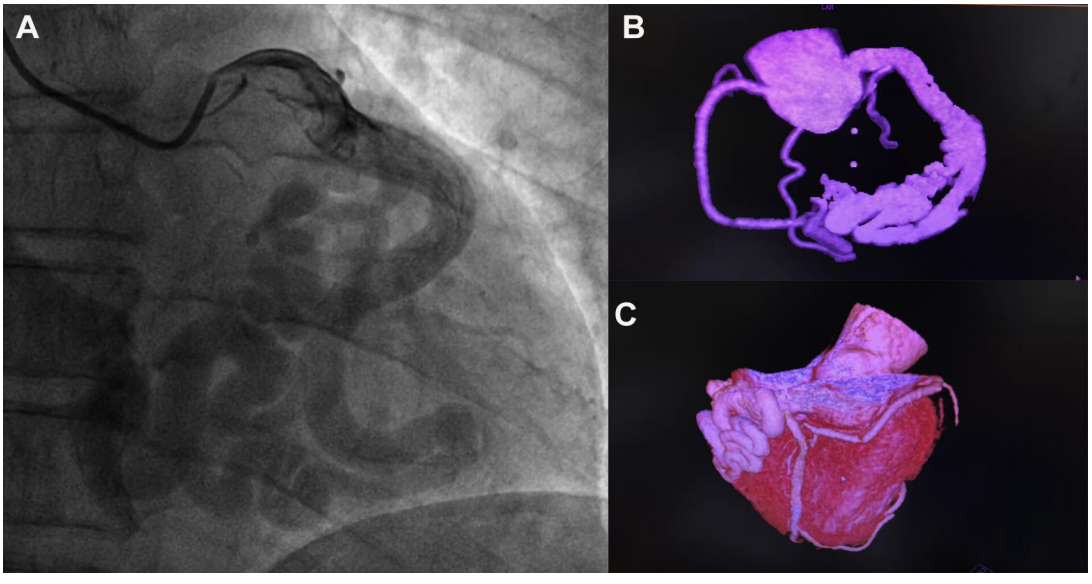
AMI = acute myocardial infarction

CAF = coronary arteriovenous fistula

LCX = left circumflex

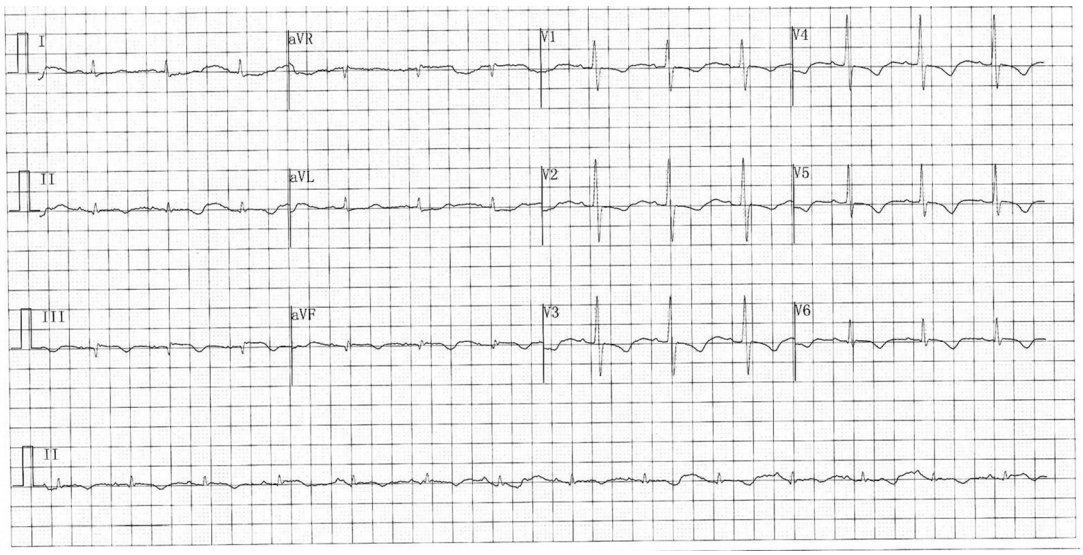
TIMI = thrombolysis in myocardial infarction

FIGURE 1 Large Fistula From the Distal Left Circumflex to the Right Atrium With Left Circumflex Ectasia and Tortuousness



(A) Coronary angiography showing a fistula extending from the distal left circumflex to the right atrium. **(B, C)** Three-dimensional enhanced computed tomography showing the fistula and largely dilated and tortuous left circumflex.

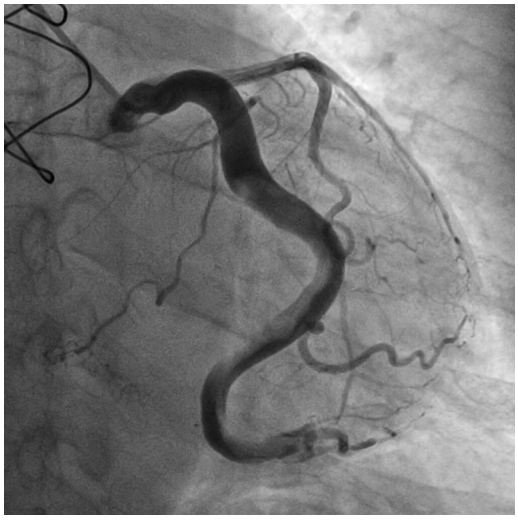
FIGURE 2 Electrocardiography Showing Q-Wave in the II to III and avF Leads



Electrocardiography shows Q waves in the II to III and avF leads with slight elevation of the ST-segment.

symptoms. Medical management, transcatheter closure, and surgical closure are the current standard treatments for CAF. Shah et al[1] showed that patients with distal fistulas present a significant challenge for transcatheter closure. The patient in our case had symptoms and dilated LCX, which might have caused heart failure in the future.[2] Given that the fistula was very large and distal for transcatheter closure, surgical closure was performed.

FIGURE 3 Thrombosis in the Dilated Left Circumflex



Coronary angiography showing massive thrombosis in the dilated left circumflex, and the fistula between the left circumflex and the right atrium is closed.

Thrombosis of the coronary artery is a severe complication after surgical closure. Several studies have reported on the occurrence of acute myocardial infarction (AMI) after surgery or during the perioperative period. Lahiri et al[3] described a 3-year-old boy who underwent transcatheter closure of a right coronary artery to right ventricular fistula (large distal fistula) with the use of an 8-mm Amplatzer vascular plug II device and experienced AMI after 20 hours. Poretti et al[4] presented a case in a 52-year-old woman who underwent surgical closure of the circumflex artery to coronary sinus fistula and experienced AMI 2 days later. However, there have been fewer cases of late-onset AMI after fistula closure. Hamada et al[5] described a 26-year-old man who underwent closure of the left anterior descending artery to right ventricular fistula and presented with AMI 9 months later. In addition, Gowda et al[6] reported 2 patients who experienced AMI 10 months and 40 years, respectively, after surgical closure of the fistula. In our patient, despite daily administration of antiplatelet drugs postoperatively, she experienced AMI 4 months later.

FIGURE 4 No Stenosis or Occlusion in the Dilated Left Circumflex

Coronary angiography showing no stenosis or occlusion in the dilated left circumflex.

It has been postulated that a large, distal-type CAF potentially confers a higher risk for coronary thrombosis after closure.[6,7] Medical prevention of coronary thrombosis in patients after CAF closure has not been well documented. Antiplatelet drugs are commonly used in clinics. Gowda et al[6] treated patients without significantly dilated coronary arteries with aspirin and those with significantly dilated residual segments with warfarin. They also considered a combination of warfarin and an antiplatelet agent in a patient with a very large residual vascular structure with a very sluggish flow.[6] In our case, the angiogram showed a largely dilated LCX and delayed coronary outflow (TIMI flow grade 2), which were the causes of thrombosis, and the patient experienced AMI while taking antiplatelet drugs. After changing the antiplatelet drug to anticoagulant therapy, repeated angiography showed no thrombosis or stenosis in the LCX, and the patient had no adverse events at the 1-year follow-up visit.

FOLLOW-UP

Considering that the LCX was largely dilated, tortuous, and with a TIMI flow grade 2, we chose to use anticoagulants (rivaroxaban) as replacement of antiplatelet drugs for the prevention of coronary thrombosis after AMI, and the patient was followed up for 1 year.

CONCLUSIONS

With this case report, we emphasize the risks (large and distal fistula, dilated coronary artery, TIMI flow grade 2) for AMI after surgical closure of the CAF and that anticoagulants may be a better choice for such patients.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

This study was supported by the National Natural Science Foundation of China (No. 82000252). The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr. Ping Wang, No. 568, Zhongxing North Road, Department of Cardiology, Shaoxing People's Hospital, Shaoxing Hospital of Zhejiang University, Shaoxing 312000, China. E-mail: 13336701800@163.com.

REFERENCES

1. Shah AH, Osten M, Benson L, et al. Long-term outcomes of percutaneous closure of coronary artery fistulae in the adult: a single-center experience. *Catheter Cardiovasc Interv*. 2020;95:939–948.

2. Shmueli H, Zahn EM, Odudu G, Flint N, Siegel RJ, Tompkins R. Coronary artery fistula: an unexpected cause of heart failure in a 58-year-old woman. *J Am Coll Cardiol Case Rep*. 2020;2:1192–1195.

3. Lahiri S, Qasim A, Qureshi AM, Molossi S, Gowda ST. Coronary thrombosis and acute myocardial infarction in a child following device closure of coronary artery fistula. *J Am Coll Cardiol Cardiovasc Intv*. 2021;14:e21–e22.

4. Poretti G, Lo Rito M, Varrica A, Frigiola A. A case report of a coronary artery fistula to coronary sinus with giant aneurysm: risk does not end with repair. *Eur Heart J Case Rep*. 2020;4:1–6.

5. Hamada M, Kubo H, Matsuoka H, Kokubu T, Oosuga Y, Joh T. Myocardial infarction complicating surgical repair of left coronary-right ventricular fistula in an adult. *Am J Cardiol*. 1986;57:372–374.

6. Gowda ST, Latson LA, Kutty S, Prieto LR. Intermediate to long-term outcome following congenital coronary artery fistulae closure with focus on thrombus formation. *Am J Cardiol*. 2011;107:302–308.

7. Latson LA. Coronary artery fistulas: how to manage them. *Catheter Cardiovasc Interv*. 2007;70:110–116.

KEY WORDS anticoagulant therapy, coronary artery fistula, thrombosis

APPENDIX For supplemental videos, please see the online version of this paper.