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CASE REPORT

ADVANCED

CLINICAL CASE

Blast Injury

A Very Rare Cause of Left Coronary Artery Dissection

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ABSTRACT

Acute coronary artery dissection commonly occurs in young women without cardiovascular risk factors. Predisposing factors, including fibromuscular dysplasia or other vasculopathies, have been demonstrated in its etiology. Here we report the case of a 46-year-old-man who presented with left anterior descending coronary artery dissection caused by blast injury after a bomb explosion. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:1898-1902)

HISTORY OF PRESENTATION

A 46-year-old man from Somalia was admitted to our hospital (Lokman Hekim University, Akay Hospital, Ankara,Turkey) with typical chest pain manifesting as uncomfortable pressure in his chest radiating into his neck and left arm. This pain occurred after walking for 50 m and lasted for 10 to 15 minutes when resting. The pressure became worse on physical exertion. Further, shortness of breath accompanied his chest pain and increased with activity. His blood pressure was 100/60 mm Hg, and his heart rate was 93 beats/min. Bilateral crackles (rales) were auscultated in both lungs, and cardiac auscultation revealed an S_3 sound.

LEARNING OBJECTIVES

- To be able to evaluate major vessel and organ damage caused by a blast shockwave and penetrating injuries caused by shrapnel fragments from the blast area.
- To be able to perform coronary angiography with advanced imaging modalities, such as intravascular ultrasound or optical coherence tomography, to evaluate whether there is coronary artery dissection.
- To be able to make a decision about how to treat coronary artery dissection, depending on the underlying cause in different cases.

PAST MEDICAL HISTORY

Although the patient did not have any cardiovascular risk factors, he had been injured in a bomb explosion during a terror attack in Somalia 1 week before admission. After the blast injury, he was immediately taken to the emergency department, and soft tissue injuries caused by shrapnel fragments were detected in his extremities, his forehead, and his chest. Meanwhile, he reported chest discomfort and shortness of breath. He could not be examined for these symptoms because of the lack of imaging devices. After the care team dressed the soft tissue injuries, the patient was discharged from the hospital. However, he continued to have chest pain and dyspnea for 5 days after the blast injury. Therefore, he was

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referred to our hospital in Turkey for further examination.

DIFFERENTIAL DIAGNOSIS

We differentiated among acute coronary syndrome, vessel injury, and cardiac contusion.

INVESTIGATIONS

An electrocardiogram (ECG) showed T-wave inversion in leads V_5 to V_6 and D_1 to aVL. His laboratory findings were normal, with the exception of a highly elevated troponin T level of 680 ng/mL.

A transthoracic echocardiogram revealed impaired left ventricular (LV) function in the apex, anterior, and anterolateral walls. His ejection fraction was 38%. We performed computed tomography to investigate great vessel and organ injury and to determine whether there was any bleeding. This imaging revealed shrapnel fragments in the soft tissue; however, the organs and great vessels were normal. Because of metal fragments in the soft tissue, we could not perform cardiac magnetic resonance, which is an essential technique to identify cardiac injury.

Subsequently, coronary angiography showed a long spiral dissection from the left anterior descending (LAD) coronary artery ostium to the third diagonal branch, including the second diagonal artery ostium with Thrombolysis In Myocardial Infarction (TIMI) flow grade 2 (**Figures 1A and 1B,** Videos 1 and 2). The circumflex and right coronary arteries were normal.

MANAGEMENT

We performed percutaneous coronary intervention (PCI) because the patient had angina and dyspnea. An ECG revealed T-wave inversion in leads V_5 to V_6 and D_1 to aVL and a transthoracic echocardiogram demonstrated apex anterior and anterolateral wall dysfunction with a reduced ejection fraction. We carefully crossed the LAD artery with a 0.014-inch floppy guidewire. Then, we implanted 3 drug-eluting stents distally to cover the dissection proximally (3.0 × 33 mm, 3.0 × 28 mm, and 3.5 × 34 mm drug-eluting stents). The final image showed the revascularization of the LAD artery with TIMI flow grade 3 (**Figures 2A and 2B,** Videos 3 and 4). No residue lesions or dissections were detected thereafter. The patient was discharged after 4 days without any complications.

DISCUSSION

Acute coronary artery dissection, ranging from unstable angina to sudden cardiac death, occurs with different presentations and can be life-threatening. Therefore, early detection and treatment are essential to reduce mortality and morbidity (1). Nevertheless, the diagnosis can be challenging, so multiple angiographic views or intravascular ultrasound examinations are helpful to confirm the dissection (1).

Although the pathologic mechanism is not fully understood, acute coronary artery dissection can be

ABBREVIATIONS AND ACRONYMS

CABG = coronary artery bypass grafting

ECG = electrocardiogram

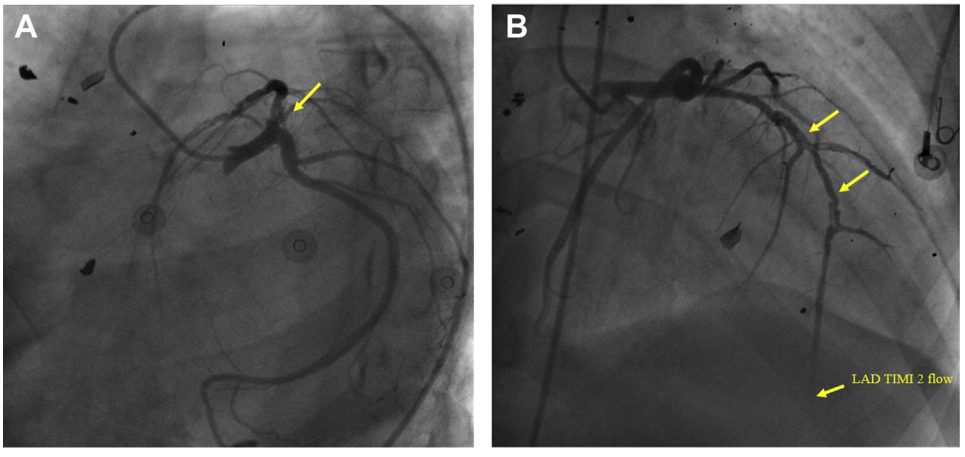
LAD = left anterior descending

LV = left ventricular

PCI = percutaneous coronary intervention

TIMI = Thrombolysis In Myocardial Infarction

FIGURE 1 Coronary Angiography Showing Spiral Dissection at the LAD Ostium and Midregion on the Spider View



(A) Spider view. Spiral dissection on the left anterior descending artery (LAD) ostium (**yellow arrow** shows the ostial dissection). Shrapnel fragments can be also seen. **(B)** Anteroposterior cranial view. Spiral dissection on the left anterior descending artery (LAD) midregion including the second diagonal branch ostium (**yellow arrows** show the spiral dissection) (left anterior descending coronary artery TIMI [Thrombolysis In Myocardial Infarction] flow grade 2).

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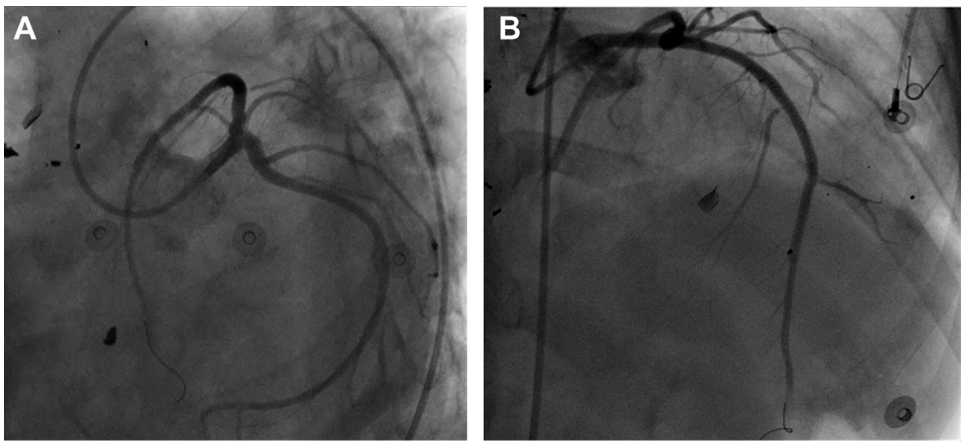
FIGURE 2 Final Angiogram After Stent Deployment



(A) Spider view. **(B)** Anteroposterior cranial view

clinically divided into atherosclerotic dissection and spontaneous dissection (including peripartum and idiopathic, iatrogenic, and traumatic coronary artery dissection) (2). Atherosclerosis is the main cause because it increases the density of the vasa vasorum and thereby leads to acute coronary artery dissection (2). In peripartum acute coronary artery dissection, the cause is thought to be physiologic hemodynamic stresses or hormonal effects that weaken the coronary arterial walls (3). In addition, most cases of acute coronary artery dissection of unknown origin are idiopathic. Affected patients are often healthy young women without any conventional atherosclerotic risk factors. Furthermore, autoimmune diseases, such as systemic lupus erythematosus, and genetic connective tissue diseases, such as Marfan syndrome, may be risk factors for this group (4). Similarly, an association of fibromuscular dysplasia with acute coronary artery dissection has been suggested, but there is no definitive evidence (2,4).

Although the mechanism of spontaneous coronary artery dissection is not entirely understood, intramural hemorrhage with or without intimal tearing has been demonstrated between the epicardial artery layers in patients with spontaneous coronary artery dissection. This condition distinguishes it from other causes, such as atherosclerosis and trauma (5). Medical treatment is recommended for spontaneous coronary artery dissection because it allows the arteries to heal over time. However, medically refractory angina pectoris and hemodynamic instability should be treated by PCI or coronary artery bypass grafting (CABG) according to the coronary artery location and lesion type. PCI is challenging for these patients, who have increased complication rates and lower procedural success (4). CABG failure is higher because of extension of the dissection beyond the graft anastomosis and loss of the true lumen. Thus, CABG is considered to be a bailout therapy for acute ischemia and infarction when PCI is unsuccessful.

Traumatic coronary artery dissection is a rare fatal cause of acute coronary syndrome, and its management and treatment strategies are less well defined. There are different mechanisms leading to traumatic coronary artery dissection, such as vascular spasm and intimal tear or rupture, which are different from the underlying mechanisms of spontaneous coronary artery dissection. Treatment strategies differ from those in patients with spontaneous coronary artery dissection, depending on how the dissection forms. Medical treatment can be an option for stable patients without any chest pain and PCI, and CABG strategies should be performed depending on the presentation and the patient's hemodynamic condition (6,7).

Blunt chest trauma is a main cause of traumatic coronary artery dissection that results in chest wall injuries and severe cardiac and great vessel injuries. Blunt trauma to the chest mainly is caused by collisions during motor vehicle accidents or sporting events that result in a sudden deceleration of kinetic energy when the body in motion strikes a fixed object. The second cause of blunt chest trauma is an explosion, from which cardiac injury can originate from many sources. The primary cause in these types

of injuries is the blast shockwave, which is a very strong pressure wave that can cause tissue damage and vascular shearing and tearing. The secondary cause of dissection in blast injuries is the presence of shrapnel fragments that penetrated and injured the tissue (8). Blunt chest trauma can damage the pericardium, myocardium, endocardium, and coronary arteries. The most common disorders are myocardial contusions. Thoracic blast injuries can also cause pulmonary contusions or lacerations, rib fractures, cardiac contusions, and cardiac tamponade (8). Coronary artery dissections very rarely occur, but they can have life-threating complications.

Coronary artery dissection is mostly seen in the LAD artery (76%), the right coronary artery (12%), and the circumflex artery (6%). Given the proximity of the LAD artery to the chest wall, the incidence of LAD artery dissection is higher than that in other coronary arteries (2).

A diagnosis of coronary artery dissection is very difficult to determine in blast injury cases. Serial ECG follow-up and regional wall abnormalities on the echocardiogram can be helpful in most cases. Previous studies have reported blunt chest trauma as the cause of coronary artery dissection (9,10). Coronary artery dissection can sometimes lead to ST-segment elevation myocardial infarction. However, no cases of coronary artery dissection associated with blast injury have been reported in the literature. In our patient, the blast shockwave caused vascular shearing and tearing, so LAD artery dissection occurred. The patient also had penetrating injuries from shrapnel fragments, which caused further soft tissue damage. In previous studies, no specific treatment modality was established for this clinical situation. Conservative treatment is recommended in patients without any complications, such as LV dysfunction and refractory angina, malignant arrhythmias, and cardiac biomarker elevation with ECG changes. In the acute phase of any complication, primary PCI should be performed, except in small and medium arteries with normal blood flow. PCI should be performed by experienced interventional cardiologists using optical coherence tomography or intravascular imaging techniques; surgical backup is important because of the increased risk of complications. The treatment plan must be individualized. In the present case, the patient was symptomatic with LV dysfunction, so we performed PCI, with successful results.

FOLLOW-UP

At the 2-month follow-up, the patient denied having angina events. A transthoracic echocardiogram demonstrated mild LV systolic dysfunction, and his ejection fraction was 46%. His medication included 80 mg acetylsalicylic acid, 90 mg ticagrelor twice a day, beta-blockers, angiotensin-converting enzyme inhibitors, and an aldosterone antagonist.

CONCLUSIONS

Coronary artery dissection can occur after blast injury. This is rare but can be fatal. We presented a patient with LAD artery dissection caused by a bomb explosion. After blast injuries, coronary artery damage and dissection should also be considered as possibilities. Blast injury-related acute coronary artery dissection can be treated with PCI at experienced centers.

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