

## CASE OF THE MONTH

### Not All Heart Attacks Are Created Equal

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### CASE HISTORY

A 79-year-old man was brought by emergency medical services (EMS) to an outside hospital after experiencing severe chest pain followed by syncope. At home, he was found to be in acute respiratory distress and required intubation by EMS while en route. On arrival to the hospital, his blood pressure was 93/54 mm Hg and heart rate was 80 bpm. His oxygen saturation was 100%. Neck veins were mildly distended. Auscultation of lungs showed diffuse rales, and a holosystolic murmur was audible at the apex. Lower extremities were cool with mild edema.

**Figure 1.** Electrocardiogram done in the emergency department.

An electrocardiogram (ECG) done upon arrival showed sinus rhythm anterior ST segment elevation and T-wave inversion consistent with ST-segment elevation myocardial infarction (STEMI) but also with loss of R-wave progression in the anterior leads (Figure 1). The patient was taken acutely to the catheterization laboratory where a total occlusion of the left anterior descending artery (LAD) was seen right after the origin of a first septal perforator (Videos 1, 2).

**Video 1.** Injection of left coronary artery (LCA) in the caudal RAO view. <https://youtu.be/Hl6r07FFAKg>

**Video 2.** Injection of LCA in the caudal RAO view. <https://youtu.be/IG1zetRw8zM>

### QUESTION 1

What is seen in video 2?

- LAD is in the process of being dilated
- Distal migration of LAD thrombus
- Distal migration of LAD thrombus and new thrombus in proximal circumflex artery
- Catheter-induced coronary dissection

### ANSWER

*C: Distal migration of LAD thrombus and new thrombus in proximal circumflex artery*

The angiogram shows a guide wire that passed the proximal occlusion with the tip in the distal LAD. There is now total occlusion of the mid LAD indicative of distal thrombus migration. In addition, there is a new area of radiolucency in the proximal circumflex artery (Circ), likely due to a thrombus.

### QUESTION 2

What should be done next?

- a. Perform percutaneous transluminal coronary angioplasty (PTCA) of LAD and manage the Circ thrombus medically
- b. Suction the LAD and Circ thrombi
- c. Abort and send patient for emergent coronary artery bypass (CAB)
- d. Perform percutaneous coronary intervention (PCI) in both LAD and Circ

## ANSWER

*D: Perform PCI in both LAD and Circ*

The TOTAL trial (The Trial of Routine Aspiration Thrombectomy with PCI versus PCI Alone in Patients with STEMI)<sup>1</sup> was a prospective randomized trial that included 10,732 patients with STEMI. Patient were randomly assigned to two treatment strategy groups: routine upfront manual thrombectomy versus PCI alone. There was no significant difference in the rates of the primary outcome (death from cardiovascular causes, recurrent myocardial infarction, cardiogenic shock, or New York Heart Association [NYHA] class IV heart failure within 180 days) with HR 0.99 (95% CI 0.85-1.15);  $P = 0.86$ . However, the rates of the safety outcomes—stroke within 30 days—were significantly higher in the thrombectomy group with HR 2.06 (95% CI 1.13-3.75);  $P = 0.02$ . Guided by the results of this trial, the operators did not proceed with transcatheter thrombectomy. Percutaneous coronary angioplasty of both vessels was performed with complete restoration of flow.

## PAST MEDICAL HISTORY

The following medical history was subsequently obtained. In March 2018, the patient presented to another hospital with acute heart failure and was found to have severe mitral and aortic regurgitation. He underwent aortic valve replacement with a biologic Carpenter-Edwards valve, and mitral valve repair with a 31-mm St. Jude Attune ring. In May, after a week of progressive fatigue and dyspnea, he presented with syncope, fever and chills, and was diagnosed with endocarditis with enterococcus faecalis. He received intravenous antibiotics for 6 weeks with apparent clinical improvement.

The patient had no history of alcohol, tobacco or illicit drug use. He worked as an engineer.

## HOSPITAL COURSE

The patient remained hypotensive and requiring full respiratory support. A portable chest x-ray showed bilateral pulmonary edema (Figure 2). At this time, the working diagnosis was recurrence of endocarditis with embolization to the left coronary artery and respiratory distress. This further validates the decision to perform angioplasty rather than thrombectomy during the catheterization. Because of the patient's critical condition and the possible need for emergency surgery, he was transferred to our institution for further tertiary care.

**Figure 2.** Supine portable chest x-ray.

Upon arrival to our hospital, the patient was placed in the intensive care unit on mechanical ventilation. He initially required vasopressor support but was gradually weaned. A bedside transthoracic echocardiogram showed normal left ventricle (LV) function with an estimated ejection fraction of 60 to 65 percent. A bedside transesophageal echocardiogram (TEE) was performed (Video 3).

**Video 3.** Mid-esophageal view at 120 degrees showing the mitral valve and prosthetic aortic valve. Note the multiple small masses in the MV, and the mobile filamentous mass attached to the ring consistent with vegetations. Also note the large rounded mass attached to the LV outflow side of the aortic prosthesis. Color Doppler shows significant mitral regurgitation. <https://youtu.be/OswbPXRy -I>

A computed tomography (CT) scan of the entire body was positive only for discitis/osteomyelitis at C5-6, also confirmed by magnetic resonance imaging (MRI), and presumed to be from septic embolization. Neurosurgery was consulted and recommended conservative management.

On the third hospital day, the patient underwent aortic annulus debridement and reconstruction with a pericardial patch, followed by aortic valve replacement with a 23-mm Trifecta bioprosthesis. He also underwent mitral valve replacement with a 29-mm Medtronic Mosaic bioprosthesis. His postoperative course was uneventful. Multiple cultures obtained for bacteria, fungus and tuberculosis were all negative.

The patient was seen as an outpatient one month after discharge from the hospital. He was recovering well and feeling much better.

## DISCUSSION

This case illustrates acute myocardial infarction caused by coronary embolism (CE). Although it is not seen often in a daily practice, the occurrence of coronary embolism (CE) as a mechanism of STEMI in the acute setting ranges from 2.9 to 4 percent.<sup>2,3</sup> That means that roughly one out of thirty STEMI cases would have an embolic origin.

Among all the etiologies of CE, atrial fibrillation leads, constituting 28 to 73 percent of all the cases.<sup>2,3</sup> Other causes include intracardiac tumors, dilated cardiomyopathy, left ventricular aneurysms, and iatrogenic embolism during interventional procedures (air bubbles, thrombi, calcium deposits). Infective emboli with endocarditis is one of the least common etiologies and is seen in only 3.8 to 7.5 percent of all embolic STEMIs.<sup>2,3</sup> Recognition of CE as etiology for a STEMI is important from a tactical and prognostic standpoint. Since there is no underlying atherosclerosis with plaque rupture, these cases are best managed by PTCA rather than deployment of stents. With high clinical suspicion of primary CE, we might suggest performing additional work up to completely rule in/rule out this etiology (screening for coagulopathies, work-up for occult arrhythmias/infectious foci/malignancies, imaging looking for the origin of embolus). From a prognostic standpoint, *Popovic et. al.* showed that coronary embolism was associated with a higher risk of all-cause mortality (HR 4.87; CI 2.52-9.39;  $P < 0.0001$ ),<sup>3</sup> although this can be attributed to severe primary comorbidities (mainly malignancies) leading to unfavorable outcome.

## TAKE-HOME MESSAGES

- When thrombus is identified during intervention of STEMI, PCI is preferred to thrombectomy.
- Coronary embolization accounts for 3 to 4 percent of STEMIs.
- Endocarditis is among the least common causes of acute coronary embolization but should be considered in patients who are at high risk for this condition. A careful history is critical to raise clinical suspicion and order more definitive studies such as TEE.

## REFERENCES

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2. Shibata T, Kawakami S, Noguchi T, et al. Prevalence, Clinical Features, and Prognosis of Acute Myocardial Infarction Attributable to Coronary Artery Embolism. *Circulation*. 2015 Jul 28;132(4):241–50.
3. Popovic B, Agrinier N, Bouchahda N, et al. Coronary Embolism Among ST-Segment-Elevation Myocardial Infarction Patients: Mechanisms and Management. *Circ Cardiovasc Interv*. 2018 Jan;11(1):e005587.