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BEGINNER

CASE REPORT: CLINICAL CASE

Papillary Muscle Rupture Due to Delayed STEMI Presentation in a Patient Self-Isolating for Presumed COVID-19

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ABSTRACT

A 57-year-old man acutely developed chest tightness and dyspnea. Given concern that his symptoms were consistent with COVID-19, the patient self-isolated. After 1 week of worsening symptoms, the patient presented with hypoxia and hypotension. He was found to have an occluded right coronary artery and ruptured posteromedial papillary muscle. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2020;2:1633-6) © 2020 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/).

HISTORY OF PRESENTATION

On April 3, 2020, a 57-year old man with a family history notable for premature coronary artery disease presented to the emergency department with 7 days of worsening chest tightness and shortness of breath. One week before presentation, the patient woke from sleep with chest tightness, diaphoresis, and shortness of breath. Given concern for coronavirus disease-2019 (COVID-19), the patient self-isolated at home, during which time he had intermittent fevers to 101°F and cough, worsening exertional dyspnea, orthopnea, and paroxysmal nocturnal dyspnea. On presentation, he was afebrile (99.3°F), hypotensive (86/68 mm Hg), tachycardic (103 beats/min), tachypneic (24 breaths/min), and hypoxic (86% on room air).

LEARNING OBJECTIVES

- To appreciate the excess mechanical complications in patients presenting with late STEMI resulting from the COVID-19 pandemic.
- To understand the origin and physiological consequences of post-infarction acute papillary muscle rupture.

PAST MEDICAL HISTORY

His past medical history included hypertension, hyperlipidemia, former tobacco use, family history of premature coronary artery disease, stage II chronic kidney disease, and intermittent asthma.

INVESTIGATIONS

Laboratory investigations were notable for elevated creatinine (3.08 mg/dl), transaminitis (alanine aminotransferase 82 U/l, aspartate aminotransferase 44 U/l), leukocytosis (16.1 K/μl), and elevated troponin-T (1.29 ng/ml). The results of a respiratory pathogen

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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 *JACC: Case Reports* author instructions page.

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ABBREVIATIONS AND ACRONYMS

COVID-19 = coronavirus disease-2019

ECMO = venoarterial extracorporeal membrane oxygenation

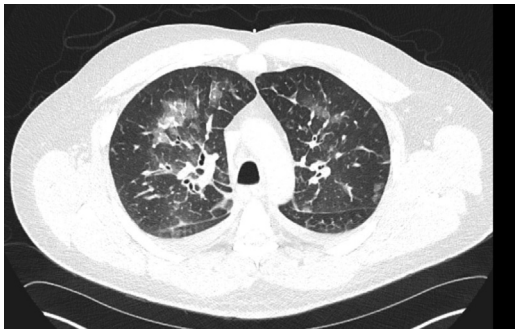
SARS-CoV-2 = severe acute respiratory syndrome-coronavirus-2

STEMI = ST-segment elevation myocardial infarction

profile, including influenza and Xpert Xpress severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) assay (Cepheid, Sunnyvale, California), were negative. Portable chest radiograph revealed right upper lung patchy opacity consistent with focal pneumonia. Computed tomography of the chest was notable for bilateral patchy, rounded, ground-glass opacities predominantly located centrally and in the upper lobes (Figure 1). The patient's electrocardiogram was notable for inferior Q waves and T-wave inversions with no ST-segment changes (Figure 2).

Given concern for hypoxia, fevers, and cough, the patient was admitted to the COVID-19 unit as a person under investigation. The result of a repeat SARS-CoV-2 test was negative. Bedside transthoracic echocardiogram demonstrated an ejection fraction of 65% with inferior hypokinesis and at least mild to moderate mitral regurgitation. Diagnostic coronary angiography was notable for an occluded right coronary artery with non-obstructive disease in the left system (Figures 3 and 4). Transesophageal echocardiography demonstrated severe mitral regurgitation with a ruptured posteromedial papillary muscle with flail P_2 and P_3 segments of the posterior mitral leaflet (Figure 5, Video 1).

FIGURE 1 Chest Computed Tomography on Presentation Showing Bilateral Central Ground-Glass Opacities With Thickened Interlobar Septa



MANAGEMENT

Despite placement of an intra-aortic balloon pump, the patient became increasingly hypoxic and hypotensive, and he required escalating doses of vasopressors. The patient was ultimately intubated and peripherally cannulated for venoarterial extracorporeal membrane oxygenation (ECMO). Two days later, following clinical improvement in oxygenation and renal function, the patient underwent mitral valve replacement with a No. 31 St. Jude mechanical mitral valve prosthesis (Abbott, Abbott Park, Illinois) and ECMO decannulation.

DISCUSSION

The incidence of papillary muscle rupture has decreased dramatically following the widespread

FIGURE 2 Presenting Electrocardiogram Showing Sinus Tachycardia With Inferior Q Waves and T-Wave Inversions

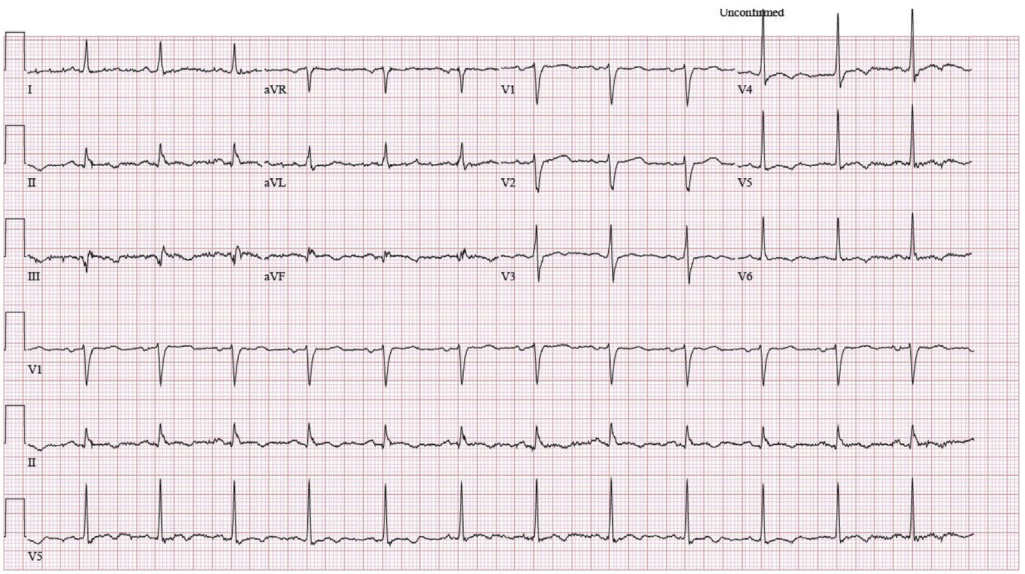


FIGURE 3 Diagnostic Coronary Angiography Demonstrating Occlusion of the Mid-Right Coronary Artery

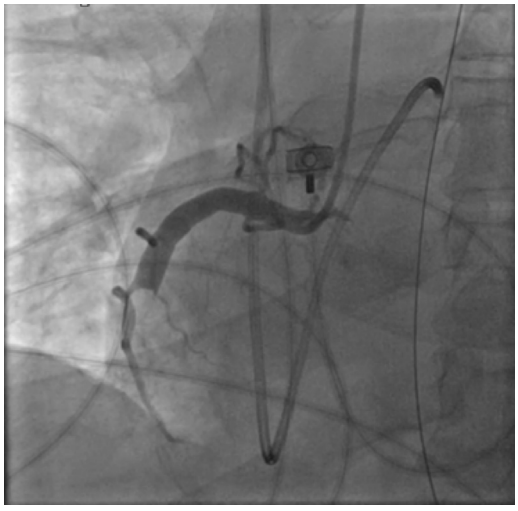
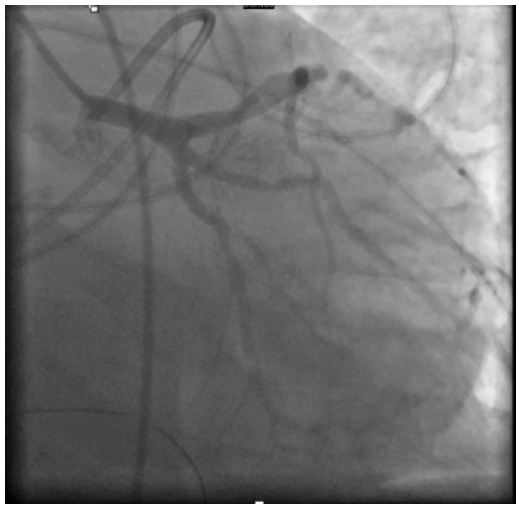


FIGURE 4 Diagnostic Coronary Angiography Demonstrating Nonocclusive Coronary Artery Disease in the Left Main, Left Circumflex, and Left Anterior Descending Coronary Arteries



adoption of primary percutaneous coronary intervention in patients with STEMI. In modern series, the incidence of ischemic papillary muscle rupture in patients presenting with STEMI is 0.25% (1). Although this complication is rare, it carries a poor prognosis, with an in-hospital mortality exceeding 50% (2).

In the setting of acute myocardial infarction, the rupture of the posteromedial papillary muscle is much more common than anterolateral papillary muscle rupture given the single blood supply of the posteromedial papillary muscle from either the dominant right coronary artery or the dominant left circumflex coronary artery. The anterolateral papillary muscle has a dual blood supply and is thus considerably less susceptible to ischemic injury. Papillary muscle rupture generally occurs between 2 and 7 days following an inferior myocardial infarction and is responsible for 7% of patients presenting in cardiogenic shock following myocardial infarction (3).

The hemodynamic consequences of acute mitral regurgitation result from the rapid delivery of a large volume load on the left atrium and ventricle leading to right-sided dysfunction. As a result of acute volume loading of an un-remodeled left atrium, there is a marked rise in left atrial pressure leading to elevated pulmonary pressure and pulmonary edema. This can result in refractory hypoxemia and cardiogenic shock (4).

Medical management of acute mitral regurgitation consists primarily of afterload reduction with vasodilators and inodilators such as sodium nitroprusside and milrinone. These patients may also benefit from mechanical unloading with an intra-aortic balloon pump or venoarterial ECMO for circulatory and respiratory support (3). Despite a high perioperative mortality (24%), surgical replacement of the mitral valve remains the cornerstone of treatment (5). The timing of surgery is generally recommended to be as early in the patient's course as is feasible (6).

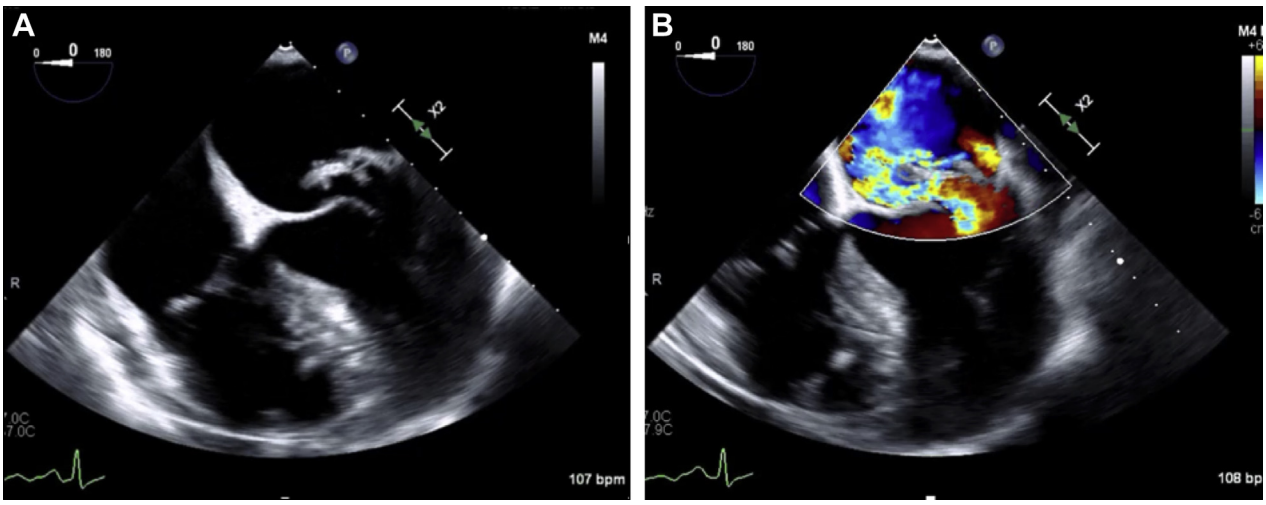
FOLLOW-UP

The patient was successfully extubated on post-operative day 1. His post-operative course was uncomplicated. He was discharged on post-operative day 9 with a therapeutic international normalized ratio. At a telemedicine visit with the patient 1 week after discharge, the patient reported no chest discomfort, shortness of breath, or activity limitations.

CONCLUSIONS

This case demonstrates the potential dangers of public messaging that encourages patients with respiratory symptoms to avoid medical care during the SARS-CoV-2/COVID-19 global pandemic. Additionally, potential anchoring bias in a patient reporting cough and fevers who presented with hypoxia led to delays in the diagnosis and management of severe

FIGURE 5 Transesophageal Echocardiographic Views



(A) Midesophageal 4-chamber view demonstrating posteromedial papillary muscle rupture with flail of the P_2 portion of the mitral valve. **(B)** Color flow Doppler demonstrating severe anteriorly directed mitral regurgitation.

mitral regurgitation secondary to a ruptured posteromedial papillary muscle and a completed inferior STEMI. Prompt recognition and surgical management of this mechanical complication of myocardial infarction are critical to ensure a satisfactory outcome.

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KEY WORDS COVID-19, papillary muscle rupture, ST-segment elevation myocardial infarction (STEMI)

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