Case Report

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Acute coronary syndrome in a young woman with a giant coronary aneurysm and mitral valve prolapse: a case report and literature review

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Abstract

Acute coronary syndrome in the young population is infrequently seen and has a different etiology from that in the elderly population. Giant coronary artery aneurysms are rare and usually asymptomatic, but they can cause acute clinical symptoms such as chest pain or chest tightness. We herein describe a young woman with a history of mitral valve prolapse who developed sudden-onset chest pain. She had mild elevations of her creatine kinase and cardiac troponin levels; however, no ST segment alteration was found on an electrocardiogram, and no abnormal regional wall movement was noted on echocardiography. Cardiac magnetic resonance imaging with late gadolinium enhancement revealed a "mass" at the right coronary artery and linear subendocardial enhancement at the posterior wall. Coronary angiography later confirmed a giant coronary aneurysm with a substantial thrombus. The combined presence of the coronary artery aneurysm and mitral valve prolapse in this patient was likely a sequela of Kawasaki disease.

Keywords

Giant coronary aneurysm, acute coronary syndrome, mitral valve prolapse, thrombosis, Kawasaki disease, coronary angiography

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Introduction

A coronary artery aneurysm (CAA) is defined as dilatation of a coronary artery segment exceeding 50% of the reference size of the adjacent segments.[1] Giant CAAs are rare in the general population, with an estimated prevalence of 0.02% to 0.2% based on the discordance of cut-off diameters.[2] Although most patients with giant CAAs are asymptomatic, some develop symptoms of acute coronary syndrome (ACS) such as angina pectoris, myocardial infarction (MI), and even sudden cardiac death.[3] We herein report a challenging case involving a patient with a history of mitral valve prolapse who presented with acute chest pain and a slightly elevated cardiac troponin level. Cardiac magnetic resonance imaging (cMRI) showed acute MI, and coronary angiography finally confirmed thromboembolism secondary to a giant aneurysm at the right coronary artery. The coexistence of mitral valve prolapse and a giant CAA in this patient was very likely to be the consequence of Kawasaki disease.

Case presentation

A 21-year-old woman presented to the emergency room with a 14-hour history of chest pain. Her chest pain had occurred suddenly at 4:00 AM while she was asleep, was restricted to the precordial region, and was accompanied by chest tightness and palpitations. She had no shortness of breath. The symptoms were tolerable and resolved on their own in about 2 hours. Eight hours before presentation, she experienced another episode of chest pain and palpitations that lasted for a few minutes. She then went to a primary care facility for an examination. An electrocardiogram (ECG) revealed sinus rhythm with ventricular ectopic beats, and cardiac enzyme studies showed that the creatine kinase (CK) level was 199 U/L, creatine kinase-MB (CK-MB) level was 24 U/L, and cardiac troponin T (cTnT) level was 0.91 ng/mL. She was then transferred to our hospital for further evaluation and treatment.

The patient denied fever, coughing, sneezing, diarrhea, or edema during the previous 2 weeks. A heart murmur had been incidentally found 3 years previously. Echocardiography later confirmed the diagnosis of mitral valve prolapse with mild mitral regurgitation. The patient had no other medical, surgical, or traumatic history. She had no history of smoking, drinking, or drug abuse. She also had no known cardiovascular family history.

On physical examination, the patient was conscious and cooperative and felt no chest pain or palpitation. Her blood pressure was 100/56 mmHg, and her pulse rate was 98 beats per minute. She had no cyanosis, jugular vein distention, or edema in the lower extremities, and normal breath sounds were auscultated in both lungs. Her heart rhythm was regular, and a grade 3/6 late systolic murmur was auscultated at the apex.

A 12-lead ECG was recorded within 5 minutes of her arrival in the emergency room and showed sinus rhythm with normal ST-T morphology (Figure 1). We also rechecked her blood tests, and the complete blood cell count and basic metabolic panel were within the normal range. Cardiac enzyme levels remained mildly elevated (CK, 190 U/L; CK-MB, 23 U/L; and cTnT, 0.319 ng/mL). Bedside echocardiography showed anterior mitral valve prolapse with moderate regurgitation, and no regional wall motion abnormality was observed. A chest radiograph was normal.

Because her symptoms were relieved and her elevated cardiac enzymes showed no progression, the patient was kept for observation. Another cardiac enzyme analysis was ordered 4 hours later, and the laboratory reported that the CK level was 201 U/L, CK-MB level was 19 U/L, and

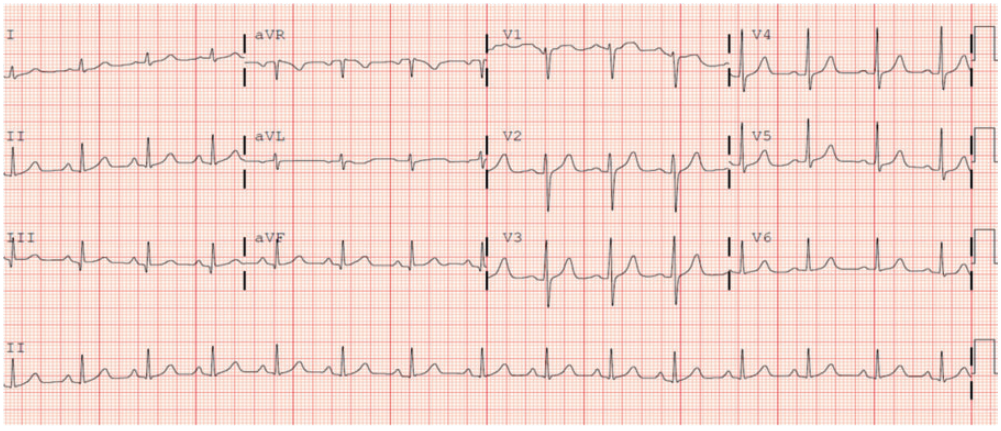

Figure 1. Twelve-lead electrocardiogram in the emergency room. Sinus rhythm with heart rate of 88 beats per minute was observed. No ST-T change was found.

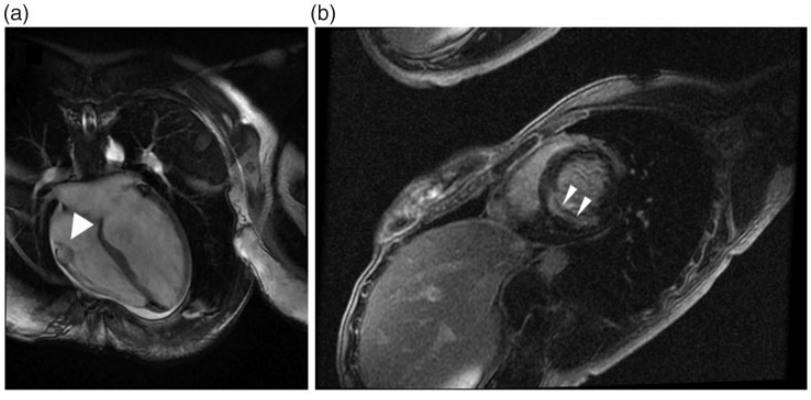

Figure 2. Cardiac magnetic resonance imaging with late gadolinium enhancement. (a) A "mass" was found at the right coronary artery (thick white arrow). (b) Delayed gadolinium enhancement demonstrated linear subendocardial enhancement at the posterior wall of the left ventricle (thin white arrows).

cTnT level was 0.240 ng/mL. During the observation period, the patient claimed no chest pain or palpitations. A second echocardiography examination showed anterior mitral valve prolapse (A3) with mild to moderate mitral regurgitation. No abnormalities of regional wall movement or contraction were observed. We also checked the patient's thyroid hormones, antinuclear antibody panel, antineutrophil cytoplasmic antibodies, and anticardiolipin antibody; all results were normal. The patient insisted on being discharged at the end of the observation period because she thought the elevation in cardiac enzymes was due to "aggravated mitral regurgitation." We decided to send her for cMRI to differentiate myocarditis from myocardial ischemia before discharge.

Unexpectedly, cMRI revealed a "mass" at the middle part of the right coronary artery on the two-chamber view (Figure 2

(a)), and delayed gadolinium enhancement demonstrated linear subendocardial enhancement at the posterior wall of the left ventricle (Figure 2(b)). Thus, acute posterior MI associated with the posterior descending artery (PDA) was highly suspected. We immediately contacted the patient and performed emergent coronary angiography. As shown in Figure 3, a giant aneurysm was present at the middle part of the right coronary artery, with a high burden of thrombosis in the sac. The other parts of the right coronary artery and left coronary arteries were normal.

We carefully questioned the patient's parents about any unusual events during her childhood. They stated that the patient had experienced an uncommon fever at the age of 2 years. The fever lasted for >2 weeks and was accompanied by skin rashes and a swollen tongue. Unfortunately, the local hospital did not provide a diagnosis and treated her with fluid infusion. She finally recovered, and no follow-up visit was performed. To our understanding, a diagnosis of Kawasaki disease was highly suspected; however the original medical records were unavailable. A cardiac surgery consultant suggested surgical correction with aneurysm excision and coronary artery bypass grafting (CABG), but the patient and her family wished to postpone the operation. The patient was treated with metoprolol succinate, aspirin, and warfarin, among which aspirin was discontinued 3 months later. During follow-up, she reported that she very occasionally felt chest tightness that lasted for only seconds; she did not experience chest pain or palpitations.

Discussion

ACS in young adults, especially those under the age of 30 years, is rare.[4] The etiology of ACS in younger patients is quite different from that in the elderly. Besides atherosclerotic plaque rupture, acute ischemic events in young individuals are usually secondary to spontaneous coronary artery dissection, coronary vasospasm, coronary embolism, microvascular dysfunction, or MI with

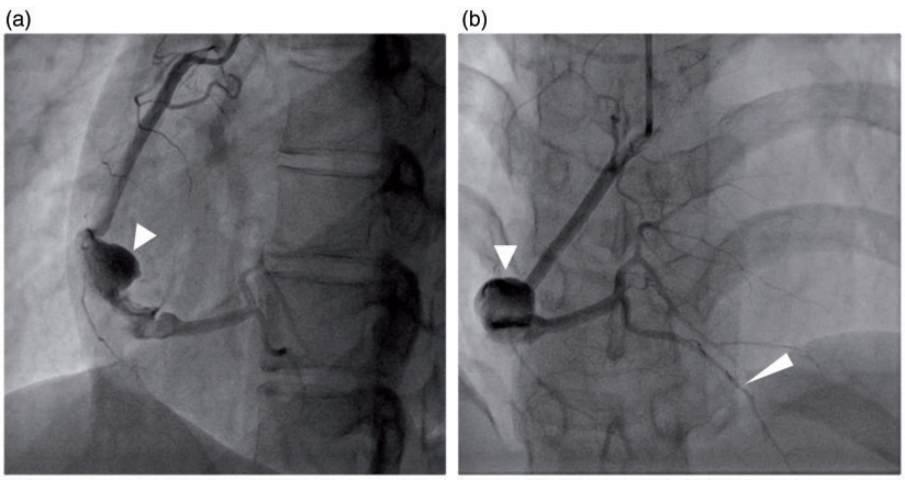

Figure 3. Coronary angiography results. Two projections were used to show the right coronary artery: (a) left anterior oblique 45° and (b) cranial 30°. The giant coronary artery aneurysm was located at the middle part of the right coronary artery (thick white arrows). A residual thrombus was found in the PDA (thin white arrow).

nonobstructive coronary arteries (MINOCA).[5] Non-ST-segment elevation MI reportedly accounts for about two-thirds of all MI in young patients, which increases the difficulty of establishing the diagnosis.[6] In the current case, although the patient presented with chest pain and chest tightness, the 12-lead ECG failed to reveal any specific changes, and biomarkers were lacking the typical "dynamic change." Thus, we initially suspected myocarditis over ACS as the primary diagnosis. Because the patient had posterior wall MI, it would have been valuable to perform an 18-lead ECG instead of a 12-lead ECG. Fortunately, however, cMRI with late gadolinium enhancement revealed the diagnosis of acute MI. cMRI serves as an essential tool in differentiating MI, myocarditis, and cardiomyopathy, and it is also reliable in determining the extent of valvular regurgitation.[7]

Studies have shown that approximately 50% of CAAs are caused by atherosclerosis, 20% to 30% are caused by congenital disorders, and 10% to 20% are caused by inflammatory or connective tissue disorders such as Kawasaki disease, Takayasu arteritis, lupus, or rheumatoid arthritis.[8] A genetic predisposition can also be involved in the formation of CAAs and coronary artery ectasia.[9] Coronary aneurysms are most commonly found in the right coronary artery (40%), with about 32% being found in the left anterior descending artery.[10] According to their morphology, CAAs are classified as saccular aneurysms if the transverse diameter exceeds the longitudinal diameter and as fusiform aneurysms if the longitudinal diameter exceeds the transverse diameter.[11] Giant CAAs might be asymptomatic or result in critical sequelae such as thrombosis, embolization, fistula formation, and rupture. Local thrombosis in proximal CAAs can lead to distal embolization and acute MI.[11] The aneurysm in the current case overwhelmed the size of adjacent vessels and had a saccular structure with a substantial thrombus, leading to a PDA embolism and resulting in MI. However, we considered that the PDA occlusion might not have lasted long because the patient's cTnT level gradually declined during the subsequent check-ups. Although increasingly more CAAs are being successfully treated by percutaneous coronary intervention (PCI), surgical correction is still preferred for the treatment of giant CAAs.[12,13] Potter et al.[14] described a patient with a giant CAA who developed ST-elevation MI as a consequence of thrombosis. The patient had a distal stenosis and underwent emergency PCI. Another previous report indicated that CAAs with a heavy thrombus load were associated with poor coronary flow (62.5%) and distal embolization (70.8%).[15] The technical challenges, appropriate devices, and cardiac surgery backup team should be carefully planned before attempting PCI in patients with a giant CAA or diffuse ectasia.

Chronic anticoagulation is considered mandatory in patients with CAAs to reduce the risk of thrombotic events. However, whether combined antithrombotic therapy should be used and for how long remain debatable. Randomized clinical trials would be difficult to conduct because of the low prevalence of giant CAAs. Su et al.[16] performed a meta-analysis to compare the safety and efficacy of aspirin alone versus warfarin plus aspirin for giant CAAs secondary to Kawasaki disease, and they found that combined treatment of warfarin and aspirin might be superior to aspirin alone. However, only six retrospective studies were included in their analysis. More evidence should be collected to determine the optimal choice of thrombosis prevention in patients with giant CAAs. Muta and Ishii[17] conducted a retrospective survey and found that patients who underwent either PCI or CABG had similar mortality rates and MI rates, but the PCI group

was more likely to undergo repeat revascularization procedures. The 2017 American Heart Association scientific statement recommended CABG over PCI in patients who had Kawasaki disease with left main coronary artery disease, multivessel CAD with reduced left ventricular function, multivessel CAD with lesions not amenable to PCI, multivessel CAD combined with diabetes, and in older children and adults with Kawasaki disease and multivessel involvement. Conversely, PCI is preferred in patients with single-vessel or focal multivessel disease amenable to PCI.[18] Although we encountered a single-vessel lesion in the present case, PCI might not have been amenable in this patient, mainly because of the size and tortuosity of the aneurysm.

Atheroma formation currently accounts for the majority of ACS. The accumulation of lipids, inflammatory cells, and vascular wall cells form atherosclerotic plaques, and some develop into rupture-prone vulnerable plaques that lead to acute cardiovascular events.[19] Kawasaki disease affects medium-sized muscular arteries such as coronary arteries, and the main pathological changes are necrotizing arteritis, subacute/chronic vasculitis, and luminal myofibroblastic proliferation.[20] Severe localized stenosis caused by thickening of the coronary artery wall after Kawasaki disease triggers myocardial ischemia.

In children and young adults, Kawasaki disease is a common cause of CAAs.[21] Both CAAs and valvular heart disease have been reported in the long-term follow-up of Kawasaki disease cohorts.[22,23] Mitral regurgitation or aortic regurgitation is the major form of Kawasaki disease associated with valvular heart disease.[24] The understanding of Kawasaki disease has been emerging in the past decade; in the past, however, many children with Kawasaki disease were not correctly diagnosed and therefore suffered from its complications. In the present case, the patient could not remember that she had experienced such an unusual fever at the age of 2 years until we asked her parents. Thus, we might consider the possibility of sequelae of Kawasaki disease in a young adult with CAAs, mitral regurgitation, and aortic regurgitation.

For patients with large or giant aneurysms (Z-score of $\geq$10 or absolute dimension of $\geq$8 mm), we consider using anticoagulants such as low-molecular-weight heparin or a vitamin K antagonist with low-dose aspirin. The risks of coronary thrombosis and occlusion must be weighed against the risks of bleeding, and the trade-offs should be periodically reassessed. For women of childbearing age with CAAs, pregnancy and birth counseling should be provided.[25,26]

Ethics statement

Written informed consent was obtained from the patient for her information and images to be published. The current human study protocol was approved by the institutional Human Research Ethics Committee, Second Affiliated Hospital, Zhejiang University School of Medicine (Ethical Approval No. 2020-467).

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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