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Case Report

The progression of symmetrical left ventricular hypertrophy in a 54-year-old man: a case report with a 10.5-year follow-up and literatures review

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Abstract: Apical hypertrophic cardiomyopathy (AHCM) is a well-known clinical entity, which is characterized by LV apex hypertrophy and the giant negative T wave at ECG and a spade-like left ventricle. It is a uncommon morphologic variant of hypertrophic cardiomyopathy (HCM) and AHCM appears to be particularly common in Asia whose prevalence was 15% and 3% of all the HCM patients in Japan and USA, respectively. In this case, we present a dramatic progress from symmetrical left ventricular hypertrophy to AHCM with apical aneurysm.

Keywords: Left ventricular hypertrophy, apical hypertrophic cardiomyopathy, apical aneurysm

Case presentation

On 26 August 2002, a 54-year-old man came to our hospital for heart palpitation and dyspnea after exercise. He had a history of arterial hypertension and hyperlipidemia without treatment. He had been smoking for nearly 30 years (4-5 cigarettes per day) and drinking Chinese spirits for nearly 50 years (1-2 taels per day). His family history was unremarkable from cardiology disease. On physical examination, his blood pressure was 120/80 mmHg, his pulse was 68 bpm, his temperature was 35.8°C and his respiratory rate was 17 bpm, his heart rate was 68 bpm with no heart murmur. A 12-lead electrocardiography (ECG) revealed sinus rhythm, left ventricular (LV) highly voltage, symmetrical, deep T-wave inversions in leads V2-V6, and biphasic T-waves in leads I, AVL, II, III, and AVF (**Figure 1A**). The exercise test revealed that R wave (S wave in lead avR) amplitude of anterior electrocardiographic leads were higher than those at rest, but R wave amplitude in the limb leads were reversed. QTc and JTc intervals were shorter and Inverted T wave amplitude were smaller when doing test in all leads. Chest X-ray and the cardiac enzymes were normal. A transthoracic echocardiography showed that LV hypertrophy is symmetric (12 mm), its end diastolic diameter of 5.0 cm, its ejection fraction (LVEF) is 60%, anteroposterior diameter of left atrial (LA) and aortic sinus is larger than normal, 45 mm and 40 mm, respectively. Coronary angiography (CAG) revealed that mid left anterior descending (LAD) coronary artery stenosis is 60% and right coronary artery stenosis is 40%. Left ventriculography is normal. Single-photon emission computed tomography (SPECT) showed decreased perfusion in regional anterior wall of left ventricle. Isosorbide mononitrate, aspirin, simvastatin and telmisartan were used for treatment. This patient was discharged with a better health condition after 13 days and he was admitted to our outpatient clinic for follow-up and medical treatment.

On 8 April 2013, this patient was hospitalized with severe dyspnea after encountering cold stimulation and minor activity. He was newly diagnosed with diabetes mellitus (DM) 6 years ago. On physical examination, his blood pressure was 150/80 mmHg, his pulse was 76 bpm, his temperature was 36.0°C and his respiratory rate was 16 bpm. ECG revealed sinus rhythm, LV highly voltage, symmetrical, deep T-wave inversions in leads I, AVL, V2-V6, and biphasic T-waves in leads II, III, and AVF. Notablely, T-wave inversions became more diffuse and deeper in leads V4-V6 (**Figure 1B**). Chest X-ray was also normal. Color Doppler flow imaging,

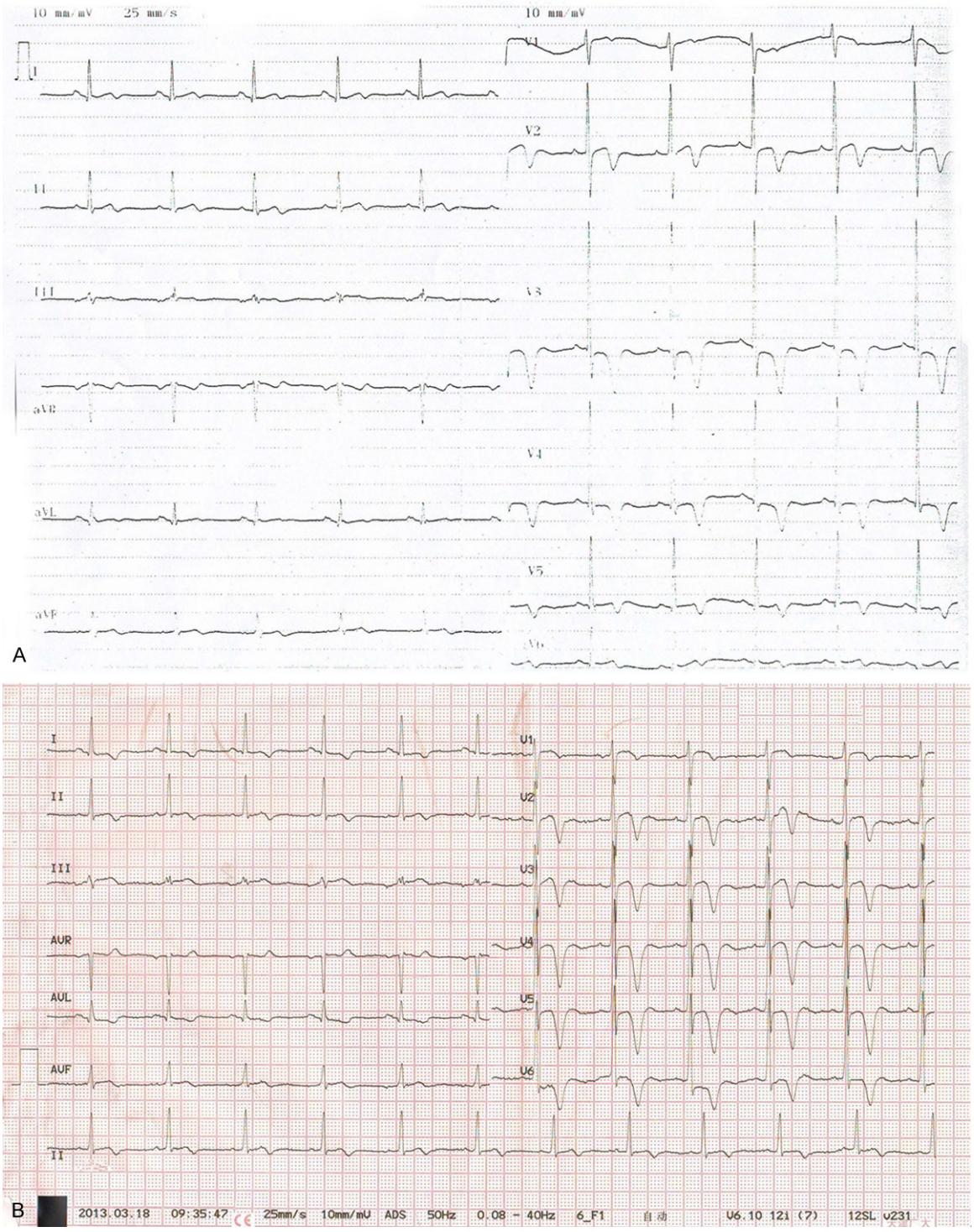

Figure 1. A. Electrocardiogram demonstated diffuse abnormal ST-T segment changes on 26 August 2002. B. Electrocardiogram showed more deeply inversive T wave in leads V4-V6.

two-dimensional and M-mode echocardiography of LV long-axis plane was used via unconventional echocardiographic views (**Figure 2A**). Anteroseptal wall and posterior wall thickness at end-diastolic phase are both 12 mm. On short-axis plane, apical wall area and cavity area were also being measured through the circumference. LV apical wall thickness at end-

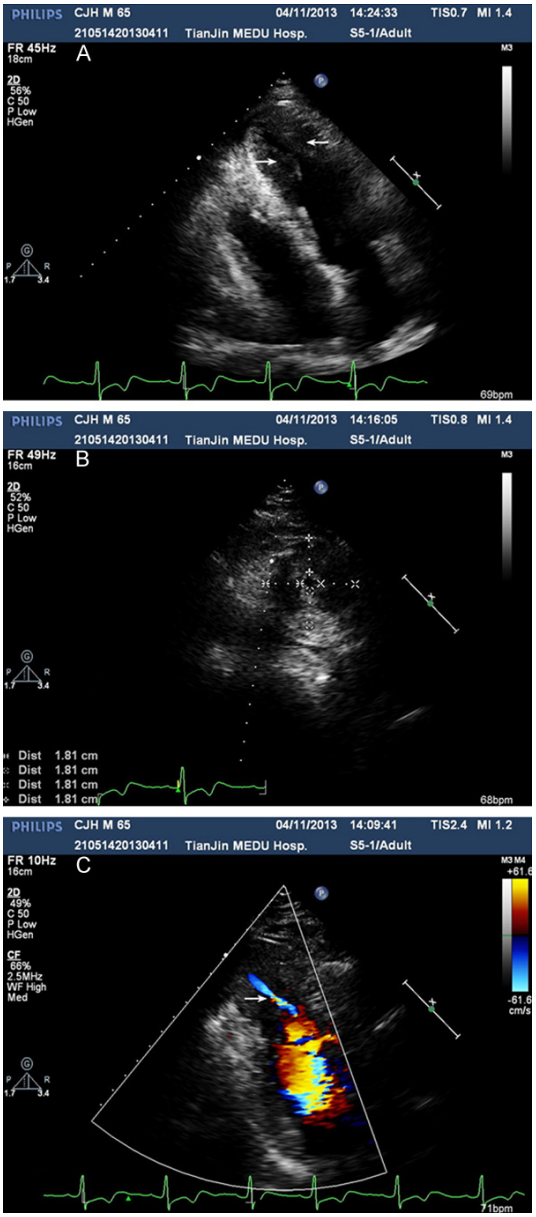

Figure 2. A. Echocardiography showed LV AHCM on unconventional views (arrows). B. Echocardiography showed LV AHCM on short-axis views. C. Color doppler flow imaging revealed paradoxical jet flow to the left ventricle during early diastole (arrow).

diastolic phase is 18.1 mm. We neither found left ventricular outflow tract obstruction nor midventricular obstruction. But color doppler flow imaging revealed paradoxical jet flow to the left ventricle during early diastole (**Figure 2B**, **2C**). CAG revealed that mid LAD coronary artery stenosis is 60%, mid intermediate branch stenosis is 50% and right coronary artery stenosis is 50%. Left ventriculography showed hypokinesis of LV apex which chamber is smaller than last result nearly 11 years ago and a spade-like structure at LV apex (**Figure 3A**, **3B**). CMR revealed LV apical hypertrophy and apical aneurysm (**Figure 4A**, **4B**). The LV myocardium had normal contractile function except thinning and paradoxical motion of apex.

So further questions about the patient's history were asked, but there was neither typical symptom of angina pectoris nor signs. We reviewed former ECGs which were no infarct's abnormal Q-wave and continuous elevation of ST segment. Serum levels of cardiac injury markers (CK, CK-MB, TnT) both maintained normal when on admission (within 3 hours after onset of dyspnea) and 12 hours after onset.

Discussion

Apical hypertrophic cardiomyopathy (AHCM) is a well-known, but rarely clinical disease. The diagnostic criteria for AHCM included demonstration of asymmetric left ventricular hypertrophy (LVH), confined predominantly to the LV apex with an apical wall thickness 15 mm and a ratio of maximal apical to posterior wall thickness 1.5, based on two-dimensional echocardiography or CMR [2].

Recent studies have found that end events of AHCM are significantly different between non-Asian patients and Asian patients. AHCM is associated with a rare occurrence of cardiovascular events in the Western population. However, several severe cardiac events such as arrhythmias and apical infarction with apical aneurysm have frequently been reported in Asian patients [3]. Eriksson MJ found that apical hypertrophic cardiomyopathy in North American patients is not associated with sudden cardiac death and has a benign prognosis in terms of cardiovascular mortality [2]. However, one third of AHCM patients may develop serious cardiovascular complications, such as myocardial infarction, arrhythmias and stroke.

AHCM is a special form of hypertrophic cardiomyopathy, a familial aggregation, now that it is an autosomal dominant genetic disease [4], patients with actin Glu101 Lys (ACTC E101K) is common mutations, also associated with myosin heavy chain Glu497 Asp (β-MHC E497D), Asp906Gly (β-MHC D906D) and many other genetic mutations [5]. Some patients, however, could not find the corresponding gene mutations, there are some patients carry mutations

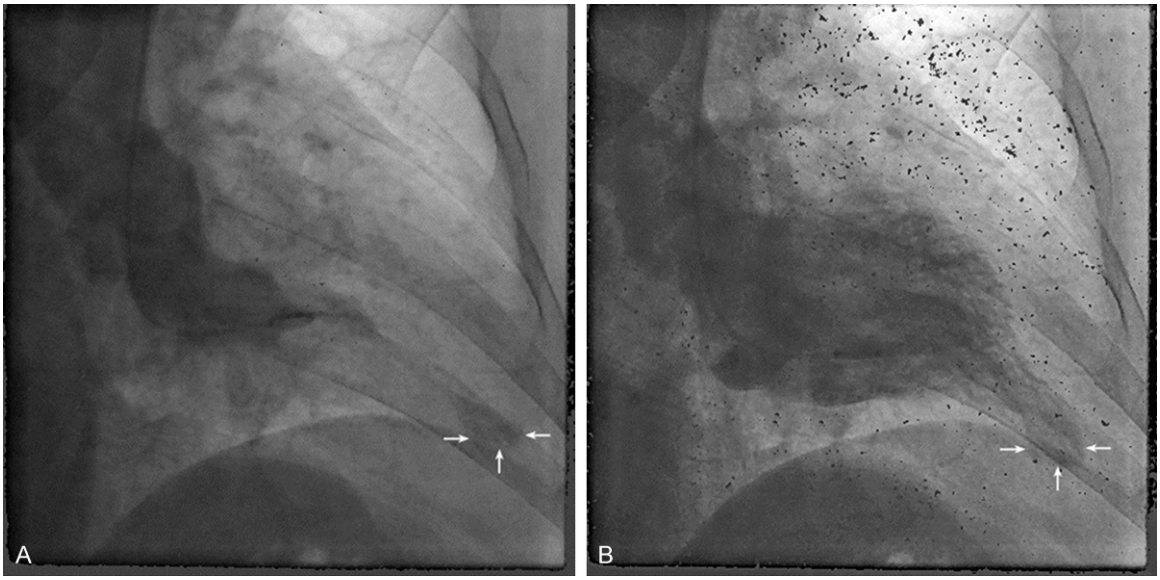

Figure 3. A. Left ventriculography showed AHCM with apical aneurysm on the LV long axis view at end-systolic phase. B. Left ventriculography showed AHCM with apical aneurysm on the LV long axis view at end-diastolic phase.

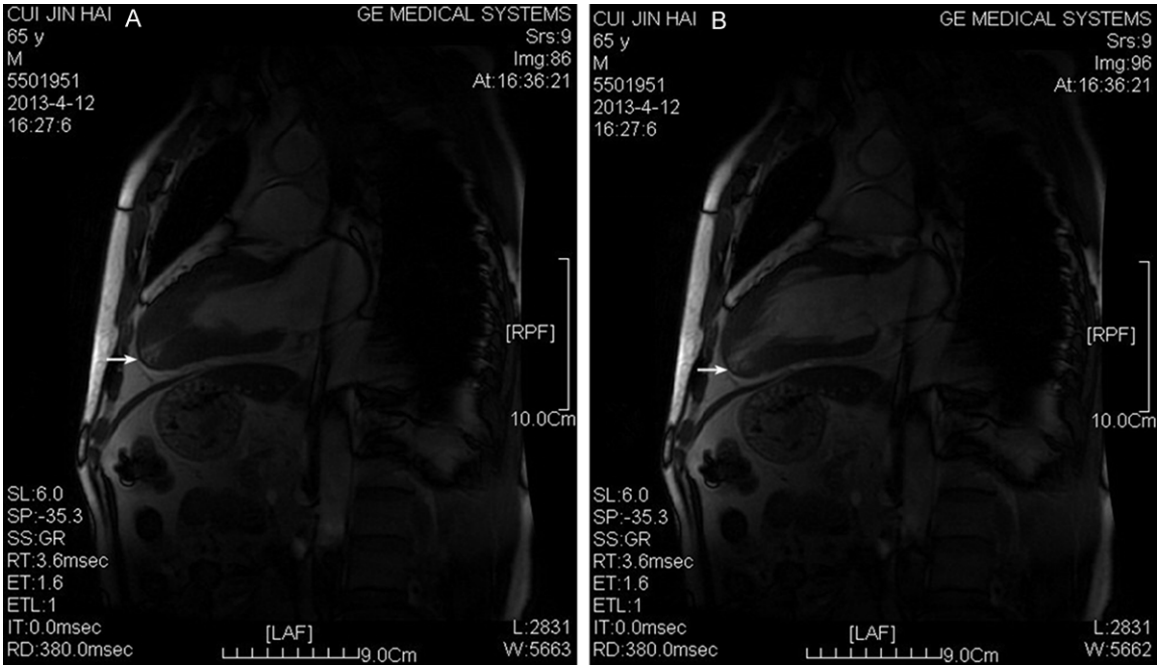

Figure 4. A. CMR showed AHCM with apical aneurysm on the LV long axis view at end-systolic phase. B. CMR showed AHCM with apical aneurysm on the LV long axis view at end-diastolic phase.

in time also does not necessarily appear clinical manifestations of AHCM. Therefore, only by genetic testing for diagnosis is not reliable.

As increased cases of AHCM and development of study, researchers have found the different morphologic progress of this cardiomyopathy. Kitaoka H have reported morphologic evolution in hypertrophic cardiomyopathy from apical hypertrophy to asymmetrical septal hypertrophy for 10 years in a 41-year-old Japanese man who felt chest pain but did not feel uncomfortable 10 years ago [6]. Otherwise, Kassis E have reported a case that diffuse hypertrophic car-

diomyopathy (HCM) developed a marked apical hypertrophy of the left ventricle during 9 years and demonstrates that such a morphological change can take place and that the clinical and haemodynamic picture can be unaffected by the progression of the left ventricular hypertrophy [7].

This patient in our case was an old man with a long history of hypertension, diabetes mellitus. Morphologic evolution in hypertrophied myocardium caused a smaller left ventricle and the normal alignment of muscle cells was disrupted, known as myocardial disarray. In addition, a mutation in one sarcomeric genes that resulted in mutating of primary protein of the myocyte. This mutation caused more apical hypertrophy of LV than common HCM morphology [8]. At present, a series of studies have suggested that diabetes-induced hyperglycemia (HG) and HG-induced oxidative stress led to myocardial fibrosis, myocyte hypertrophy [9]. Macatangay C indicated that AHCM was associated with chronic hypertension. Harada K showed that Myocardial ischemia may played an important role in the genesis of the apical aneurysm [10]. Necrosis caused by myocardial ischemia played an important role in the genesis of the apical aneurysm. Stenosis of left ventricular apex leading to high pressure in the apical chamber caused myocardial dysfunction. Compensatory thickening of myocardium improved ejection function. But thickening of myocardium accompany decreased diastolic function resulted in oxygen supply/demand mismatch and reduction of coronary perfusion. Though there was no mid-ventricular obstruction in this patient, the anteroposterior diameter of left ventricular apex at end-diastolic phase is approximately 6 mm. Apical hypertrophy which may lead to myocardial dysfunction was caused by high pressure in the apical chamber. Like end stage of hypertensive heart disease, the thinning of left ventricle region wall was contributed to formation of dilated the apical chamber. In addition, long-term mild stenosis of LAD may cause chronic ischemia of apex. The effects of these factors on AHCM with apical aneurysm were independent as well as interrelated.

In the past the long-term prognosis of AHCM was considered relatively benign, but recent studies have suggested a somewhat less optimistic opinion. Moon and Shim demonstrated that aging, hypertension and DM, are important predictors of a poor prognosis in patients with AHCM [10].

Unfortunately, we have discovered no specified treatment for AHCM. Medical management includes calcium channel blockers and β-blockers is mainly done to relieve symptoms of and dyspnea and angina by improving LV diastolic function [11]. Osawa H have found that only drug therapy even only ICD treated patients with AHCM and apical aneurysm who had an episode of syncope due to ventricular tachycardia was inadequate [12]. Reconstruction and cryoablation can be more effective.

In summary, we have briefly understood the development of AHCM with apical aneurysm by the rare case. Various methods can improve positive rate and reduce the rate of misdiagnosis. Though the pathogenesis of this disease is still perplexing. But it is a glimmer of hope from what we have done.

Disclosure of conflict of interest

None.

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