Coronary aneurysms and stenosis detected with magnetic resonance coronary angiography in a patient with Kawasaki disease

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Coronary artery abnormalities in Kawasaki syndrome develop in about 15-25% of young patients, mostly as aneurysms. In the long-term evolution of coronary artery disease thrombotic occlusion of aneurysms, premature atherosclerosis, and stenosis, are observed. Magnetic resonance is an emerging modality in the angiographic assessment of coronary arteries. The authors report a case of coronary artery aneurysms and stenosis in a 26-year-old patient with Kawasaki disease detected by magnetic resonance coronary angiography and confirmed by conventional coronary angiography.

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Introduction

The authors report a case of combined aneurysms and stenosis of the coronary arteries detected with magnetic resonance coronary angiography in a patient with Kawasaki disease.

Case report

A 26-year-old man was referred to our Department of Cardiology for cardiac evaluation because of recurrent effort angina. The patient had a clinical history of Kawasaki disease diagnosed at the age of 10, and a previous conventional coronary angiography performed at 18 demonstrating multiple aneurysms of the right and left anterior descending coronary arteries. At present, electrocardiogram showed no abnormalities and physical examination was unremarkable. Exercise testing induced marked S-T depression in leads V_2, V_3, and V_4 at low workload (50 W).

The patient underwent magnetic resonance coronary angiography at 1.5 T, performed using a non-velocity-compensated, ECG-triggered and retrospectively respiratory-gated three-dimensional gradient-echo fat-suppressed sequence (three-dimensional navigator-echo) with the following technical parameters: repetition time 7.4 ms; echo time 2.7 ms; incremental flip angle; 4 to 6 excitations; resolution, in-plane 1.2 **u** 2.3 mm, through-the-plane 2 mm; 24 phase encoding steps obtained for each cardiac cycle; acquisition window in mid-diastole 178 ms. Two contiguous 48 mm axial slabs of 24 2-mm partitions were acquired, for a total acquisition time of about 20 min. The three-dimensional data set of the coronary artery tree was analyzed by means of a multiplanar reconstruction software using straight and curve plains.

All major epicardial vessels were identified. Magnetic resonance coronary angiography demonstrated a severe stenosis of the proximal segment of the left anterior descending coronary artery and an aneurysm involving the ramus medianus of the left coronary artery (Fig. 1). Another aneurysm involving the right coronary artery from the coronary sinus to the posterior atrioventricular groove was also detected.

Conventional coronary angiography, performed after selective catheterization of right and left coronary arteries, with left and right oblique anterior views, confirmed both the stenosis and aneurysms (Figs. 1 and 2).

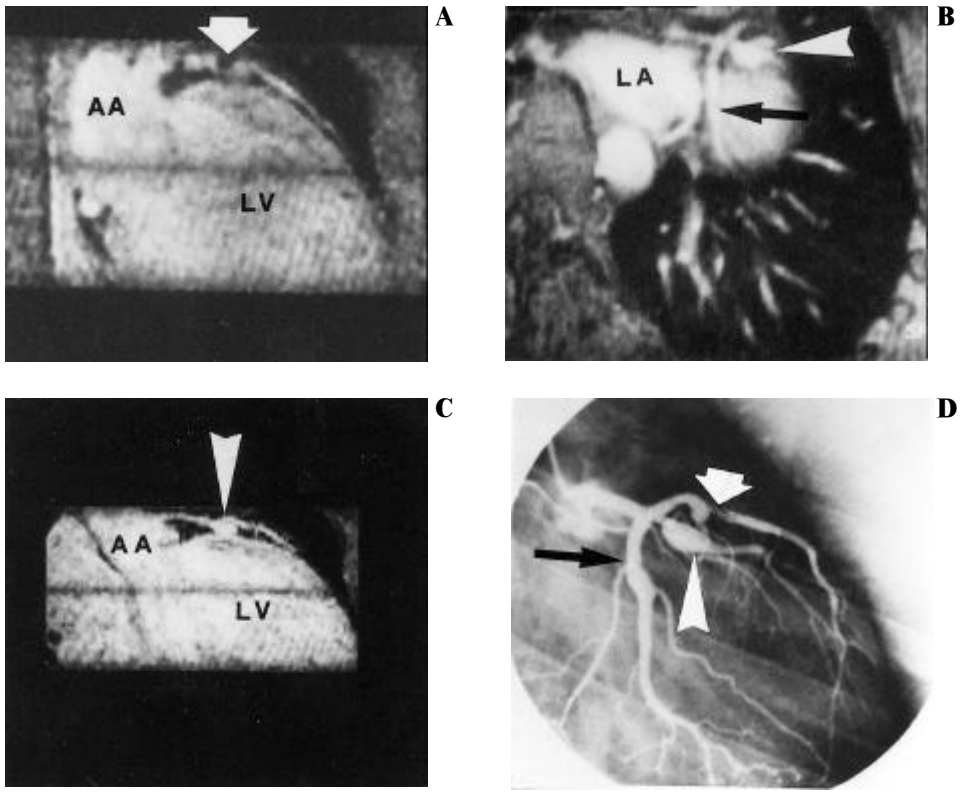

Figure 1. *A, B, and C: navigator-echo magnetic resonance coronary angiography. D: conventional coronary angiography. A: reformatted oblique sagittal image, signal attenuation (white arrow) due to coronary stenosis of the proximal left anterior descending coronary artery. B: reformatted paraaxial image, moderate dilation of the left circumflex coronary artery (black arrow) and aneurysm of the ramus medianus (white arrowhead). C: reformatted oblique sagittal image, different view of the aneurysm of the ramus medianus (white arrowhead). D: conventional coronary angiography of the left coronary artery confirming the same findings (labeled as in magnetic resonance images). AA = ascending aorta; LA = left atrium; LV = left ventricle.*

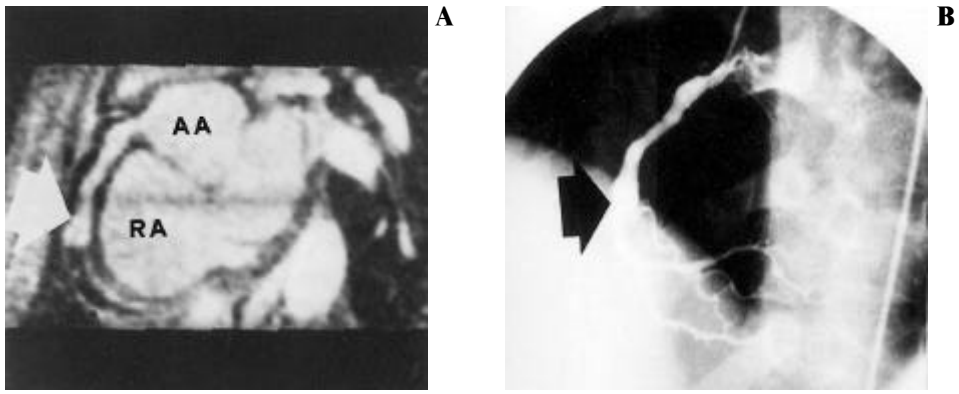

Figure 2. *A widely sized aneurysm involving the right coronary artery was well imaged by both navigator-echo magnetic resonance coronary angiography (A, white arrow) and conventional coronary angiography (B, black arrow). AA = ascending aorta; RA = right atrium.*

Discussion

Kawasaki syndrome is an acute disease probably due to a hyperimmune vasculitis, most often affecting children younger than 5 years of age[1]. Typical clinical manifestations include fever, skin rash, mucosal inflammation, and cervical lymphoadenopathy[1,2]. Coronary artery abnormalities develop in about 15-25% of young patients, mostly as aneurysms[2,3].

Adult-onset Kawasaki disease is rare[1,4]. The long-term evolution of coronary artery disease is thrombotic occlusion of aneurysms, premature atherosclerosis, coronary artery stenosis, and ischemic heart disease[2]. Coronary artery stenosis can occur up to 17 years after the onset of Kawasaki disease[2]. However, the typical evolution of coronary aneurysms in Kawasaki disease is regression[2,5]. In the large series from Kato et al.[2], 54.8% of Kawasaki disease patients with aneurysms showed regression of small or moderate size aneurysms during a 10 to 21-year follow-up.

Up to now, the gold standard in the evaluation of patients with coronary aneurysms is conventional coronary

angiography, in order to define nature and extent of coronary involvement, in particular for stenosis identification[2,3,6]. Serial two-dimensional echocardiography is also considered an important cost-effective screening tool for coronary aneurysms and follow-up in Kawasaki disease patients[2,7]. However, echocardiography yields low sensitivity for stenosis identification[6] with also severe limitation in detecting thrombosis and screening older patients[8]. Ultrafast computed tomography has also been proposed as a diagnostic tool after two-dimensional echocardiography for evaluating Kawasaki disease patients with coronary aneurysms[9].

Magnetic resonance has been proposed for imaging coronary arteries during the last 20 years. Different pulse sequences have been developed to optimize magnetic resonance coronary angiography, in particular, two-dimensional and fat-suppressed breath hold, two-dimensional segmented-k space gradient-echo techniques. However, using this approach, several breath holds are necessary to encompass the entire coronary artery tree, since a different slice orientation is required for each vessel; moreover, it permits only a low spatial resolution, with poor visualization of small and tortuous vessels and incorrect evaluation of stenoses. Recently, the three-dimensional navigator-echo technique has been developed and applied to evaluate native coronary arteries and coronary artery bypasses. This technique seems to be less operator- and patient-dependent, requiring less imaging time than two-dimensional magnetic resonance coronary angiography[10].

To our knowledge, until now only few papers concerning magnetic resonance imaging of coronary arteries in Kawasaki disease have been published[8,11-13].

Niwa et al.[11] described the cardiac abnormalities of patients with Kawasaki disease by magnetic resonance imaging in 1990. They reported the myocardial signal changes and the coronary features in 11 Kawasaki disease patients using ECG-gated spin-echo sequences. However, only the proximal portion of the coronary arteries was imaged, and no direct visualization of stenoses was possible.

In 1989 Bisset et al.[13] reported a case of aneurysms of left and right coronary arteries studied with ECG-gated spin-echo sequences. Similarly, in 1998 Kobayashi et al.[12] described a case of a giant aneurysm of the right coronary artery studied with conventional coronary angiography and magnetic resonance imaging with spin-echo sequences.

In the direct evaluation of coronary arteries good results have been obtained with white blood gradient-echo sequences, facing the main problem of respiratory movement with two-dimensional fast breath-hold technique[14] or with respiratory-gated three-dimensional navigator-echo[15,16]. Using such technical modalities, also the distal segments were visualized and relatively good values of sensitivity and specificity were obtained in detecting coronary artery stenoses[10].

Using a breath-hold ECG-gated fast gradient-echo sequence, Duerinckx et al.[8] in 1997 reported a case of a Kawasaki disease patient with coronary artery involvement, with optimal visualization of aneurysms of right and left coronary arteries in an angiographic-like fashion.

In our case a stenosis and multiple aneurysms were detected by three-dimensional navigator-echo magnetic resonance coronary angiography obtaining magnetic resonance images very similar to those of the subsequent conventional coronary angiography. So, we have demonstrated the possibility of evaluating the extent of coronary artery involvement in Kawasaki disease patients not only by assessing size and morphology of aneurysms but also by identifying and grading coronary stenoses.

Obviously, a practical role of magnetic resonance coronary angiography in Kawasaki disease is to be confirmed in large clinical trials. Three-dimensional navigator-echo magnetic resonance coronary angiography may be useful as a first approach in screening coronary arteries in Kawasaki disease patients, and could be used as an alternative to echocardiography in the follow-up of such patients, to assess regression of aneurysms and to detect stenoses.

In conclusion, navigator-echo magnetic resonance coronary angiography can be considered a useful method to evaluate coronary abnormalities in patients with Kawasaki disease. It could be proposed for coronary screening and follow-up.

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