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ORIGINAL ARTICLE

Linear shadows inside coronary arterial lesions on two-dimensional echocardiograhpy in Kawasaki disease patients

Akiko Hamaoka (MD)[a,*], Ayumi Niboshi (MD, PhD)[a], Sei-ichiro Ozawa (MD, PhD)[a], Hiroshi Tamiya (MD, PhD)[b], Hirotoshi Ito (MD, PhD)[c], Isao Shiraishi (MD,PhD)[a], Toshiyuki Itoi (MD, PhD)[a], Kenji Hamaoka (MD, PhD)[a]

[a] *Department of Pediatric Cardiology and Nephrology, Kyoto Prefectural University of Medicine, Graduate School of Medical Science, Japan*
[b] *Department of Pediatrics, Yamazaki Hospital, Hikone, Japan*
[c] *Department of Radiology, Kyoto Prefectural University of Medicine, Graduate School of Medical Science, Kyoto, Japan*

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KEYWORDS
Linear shadow;
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Summary
Background: Conventional two-dimensional echocardiography (2DE) is not adequately sensitive enough for the detection of stenotic or occlusive coronary lesions that occur in Kawasaki disease. Recently, linear shadows have been detected inside large- or moderate-sized coronary artery lesions (CALs) by high-resolution 2DE at a convalescent or chronic stage.
Purpose and methods: We evaluated the clinical significance of the linear shadows detected by 2DE and compared the findings with those obtained using coronary angiography (CAG), magnetic resonance imaging (MRI), and intravascular ultrasound (IVUS).
Results: From December 2001 to November 2006, linear shadows were detected in 11 out of 18 CALs in 9 patients at our institution. The outer diameters of the CALs by 2DE were larger than the diameters of CALs by CAG, while the inner diameters between the linear shadows by 2DE correlate with the diameters of CALs by CAG. Remarkably thickened intima was confirmed in 7 out of 9 CALs by MRI, and in every lesion that was examined using IVUS.

* Corresponding author. Tel.: +81 75 251 5832; fax: +81 75 251 5833.
E-mail address: ahamaoka@koto.kpu-m.ac.jp (A. Hamaoka).

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Conclusions: The results of this study suggest that linear shadows by 2DE would indicate the existence of a thickened intima. We consider that linear shadows may be useful to estimate the development of stenotic lesions during the process of regression or remodeling of CALs.

Introduction

Kawasaki disease (KD) involves a diffuse and systemic vasculitis of unknown etiology that mainly affects infants and children. The well-known sequelae to this disease is a coronary aneurysm that occurs in approximately 5% of all patients with KD [1]. In the long term, giant aneurysms can lead to stenotic lesions, which are caused by either intimal hypertrophy or atherosclerotic changes, thus resulting in ischemic heart disease [2—4]. Therefore, long-term follow-up for coronary artery lesions (CALs) is required. CALs have been generally detected and followed-up by non-invasive two-dimensional echocardiography (2DE) and by invasive cardiac angiography (CAG). However, there have been a few discrepancies in the findings of CALs between 2DE and CAG in patients with KD, because 2DE is still not sufficiently sensitive to detect either stenotic or occlusive lesions.

Recently, linear shadows have been detected inside CALs using high-resolution 2DE in some patients with either large or moderate aneurysms in the subacute or chronic stage of KD. Relatively straight lines and uniform low echoic spaces are observed between the lines and walls of CALs and these findings were different from those indicating thrombosis. Those lines were identified as ''linear shadows.'' This study hypothesized that these linear shadows could reflect the thickened intima that develops with the regression of a coronary aneurysm and the origin and clinical importance of linear shadows in CALs were investigated by comparing 2DE images with CAG, magnetic resonance imaging (MRI), and intravascular ultrasonography (IVUS) images.

Materials and methods

From December 2001 to November 2006, linear shadows were detected in 11 of 18 CALs that occurred in 9 KD patients (age at the onset of KD, 9 months to 15 years 8 months; duration from the onset to first detection of a linear shadow, 2 months to 1 year 8 months); these patients exhibited moderate or large-sized aneurysms at the acute stage of KD.

For 2DE, SONOS-5500 was used with an 8 or 12 MHz transducer manufactured by Philips Medical Systems (Eindhoven, the Netherlands). MRI was performed using 1.5 T systems obtained from Philips Medical Systems under an electrocardiogram (ECG) gate and respiration gate.

The bright blood method with balanced-turbo field echo was used to identify blood vessels [5]. In addition, the black blood method, which nullifies the blood flow signal by employing a velocity-sensitive inversion pulse and constructs a signal of the static blood vessel tissue was used with turbo spin echo [6,7]. IVUS studies were also performed using a Clear View Ultra from Boston Scientific Inc. (Natick, MA, USA) via a 6 F guiding catheter with a 3.5 F and 40 MHz IVUS catheter. CAG, IVUS, and MRI were performed within 2 weeks after 2DE.

Results

The clinical profiles of the 9 patients who exhibited large- or moderate-sized aneurysms in the acute stage and linear shadows inside the coronary aneurysms by 2DE in the late stage of KD are summarized in Table 1. The outer diameters of CALs were 7.1 ± 2.1 mm and the inner diameters

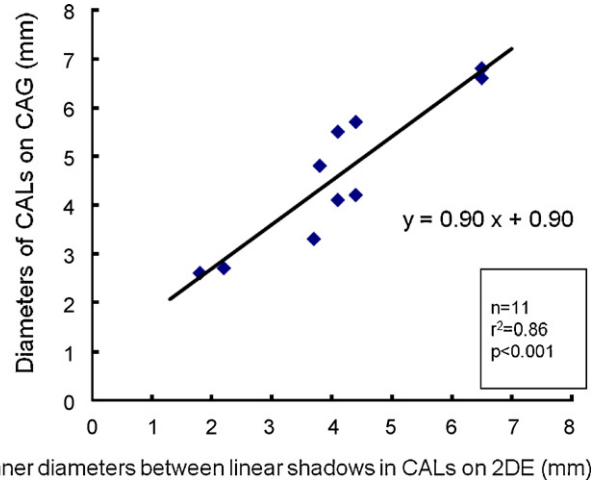

Figure 1 A statistically significant positive correlation ($y = 0.99x - 0.10$, $r^2 = 0.77$) is observed between the diameters of CALs detected by CAG and the inner diameters between the linear shadows detected by 2DE.