Coronary Artery Stenosis in Moyamoya Disease
Tissue Characterization by 256-Slice Multi-Detector CT and Virtual Histology

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A 20-year-old Korean man presented with a 3-week history of exertional chest pain to our cardiology outpatient clinic. He had been diagnosed with Moyamoya disease at the age of 5 years and had undergone bilateral extracranial-intracranial bypass surgery. His last magnetic resonance angiogram confirmed Moyamoya disease and revealed a good neovascularization of the both external carotid arteries. He had stage I hypertension but did not receive any antihypertensive medication. He denied having diabetes mellitus, dyslipidemia, tobacco use, or any family history of early atherosclerotic coronary artery disease.

A treadmill exercise test demonstrated 3-mm ST-segment elevation in leads V2, V3, V4 and II, III, aVF in stage III (Figure 1). A coronary computed tomography angiography using a 256-slice multi-detector computed tomography scanner (Brilliance iCT; Philips Medical Systems, Best, The Netherlands) showed moderate to severe discrete stenosis in the proximal left anterior descending artery (LAD) with a noncalcified plaque (Figure 2A–2C) and a mean Hounsfield Units of 87.5, indicating a fibrous plaque. The reconstructed image using dedicated automated plaque analysis software (Extended Brilliance Workspace V4.0; Philips Healthcare, Cleveland, OH) also showed an isolated noncalcified plaque in the proximal LAD (Figure 2D) and an eccentric fibrous plaque (Figure 2E).

A coronary angiogram revealed critical stenosis in the proximal LAD, whereas the remaining coronary artery segments seemed to be normal (Figure 3A). We performed intravascular ultrasound and virtual histology (VH) of the proximal LAD lesion (IVUS VH; Volcano Corp, Rancho Cordoba, CA). A grey-scale intravascular ultrasound image showed homogenous, eccentric, echogenic intimal thickening of the proximal LAD (Figure 4A, Movie I in the online-only Data Supplement). The mid and distal LAD showed no pathological intimal thickening. In detailed analysis of plaque composition by the VH, this thickened intima was mainly composed of fibrous tissue (dark green area in a reconstructed color-coded tissue map, 79% of the plaque) with minimal lipid pooling, but without any calcium deposition (Figure 4B). With regard to coronary stenosis, a drug-eluting stent was successfully implanted (3.0×18 mm Endeavor Resolute, Medtronic Inc., New York, NY). The final angiogram showed minimal residual stenosis (Figure 3B). The patient has been free from angina after the coronary intervention.

A few cases of coronary artery stenoses in patients with Moyamoya disease have been reported. The histopathology of these coronary lesions showed a homogenous, soft intimal proliferation with minimum lipid deposition and without substantial inflammatory cell infiltration. It is similar to the findings of the carotid arteries of Moyamoya-patients, but differs significantly from typical atherosclerotic plaques. This is the first report showing coronary computed tomography angiography and VH image of coronary stenosis in a patient with Moyamoya disease; the plaque characteristics demonstrated with coronary computed tomography angiography and VH were consistent with the histopathologic results reported in previous studies, described as typical fibrous intimal thickening of coronary artery. Although the combined involvement of carotid and coronary artery stenoses is rare, the coronary involvement should be considered as 1 of the causes of ischemic heart disease in young patients with Moyamoya disease.

Disclosures
None.

References
Figure 1. A, An ECG at rest. B, An ECG during stress demonstrated 3-mm ST-segment elevation in leads V2, V3, V4 and II, III, aVF.

Figure 2. An ECG-gated coronary computed tomography angiography using a 256-slice multi-detector computed tomography scanner. A, Volume rendering image. B, Curved multi-planar reconstructed image of the left anterior descending artery (LAD) showed moderate to severe discrete stenosis with a noncalcified plaque in the proximal LAD (arrow). C, Cross-sectional view of the stenotic lesion also showed moderate to severe stenosis with an eccentric noncalcified plaque which has a mean Hounsfield Units of 87.5, indicating a fibrous tissue. D, Reconstructed image using dedicated automated plaque analysis software revealed an isolated noncalcified plaque in the proximal LAD (orange color). E, In cross-sectional view of the plaque with color-coded tissue map, the purple color indicates a noncalcified plaque, which is mainly composed of fibrous tissue (mean Hounsfield Units of 87.5).
Figure 3. A, An initial diagnostic coronary angiogram revealed focal tight stenosis (arrow) of proximal left anterior descending artery (LAD). B, After percutaneous coronary intervention, the coronary angiogram showed properly dilated lumen with minimal residual stenosis (arrow).

Figure 4. A, A grey-scale intravascular ultrasound image (IVUS VH) showed homogenous, soft, eccentric intimal thickening (arrows) without calcification. B, In the virtual histology image, the thickened intima was mainly composed of fibrous tissue (dark green area, 79% of the plaque) compared with relatively small fibrous fatty tissue (light green area, 15% of the plaque) and minimal necrotic core (6% of the plaque). There was no dense calcium deposition. Lumen area was 4.0 mm² and vessel area was 11.8 mm². Percent plaque burden was 66%.
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