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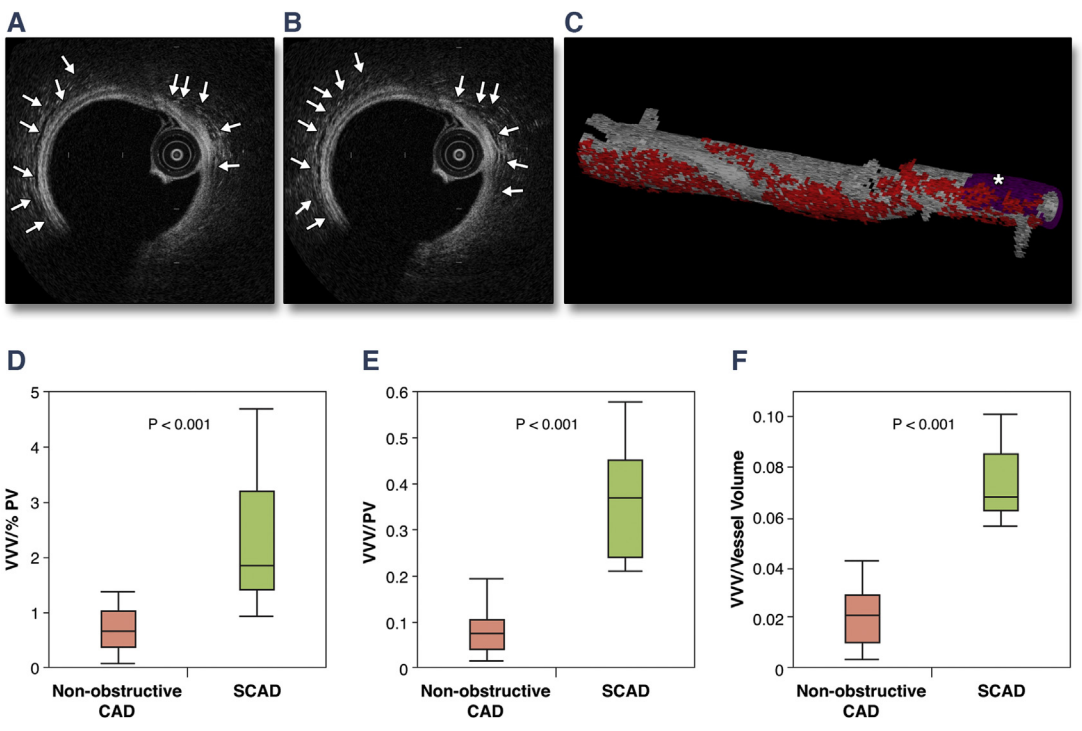
LETTERS TO THE EDITOR

Proliferation of Coronary Adventitial Vasa Vasorum in Patients With Spontaneous Coronary Artery Dissection

Spontaneous coronary artery dissection (SCAD) is one of the underlying mechanisms of acute coronary syndrome and sudden cardiac death, especially in young women. Although hemorrhage from vasa vasorum (VV) has been suggested as a possible mechanism of SCAD (1), no study has evaluated the association between VV and development of SCAD, especially not in vivo, due to a lack of suitable imaging tools. Recently, optical coherence tomography (OCT) has been introduced as a reasonable modality to evaluate adventitial VV (2). Using this technique, this study was pursued to test the hypothesis that the coronary adventitial volume of VV is higher in patients with SCAD.

From February 2011 to September 13, 2014, this study enrolled 9 consecutive patients with SCAD and 18 sex-matched control subjects with nonobstructive coronary artery disease (CAD) who had documented <30% diameter stenosis throughout the coronary arteries by coronary angiography and evaluated coronary endothelial function and OCT study during same period. The methods of OCT image acquisition and analysis have been described previously (2). Adventitial VV was defined as a microchannel having signal-voiding tubular or layer structures with major diameters from 50 to 300 μm, which were observed in at least 2 consecutive slices, and located within 1 mm from the media-adventitia border (**Figures 1A to 1C**). Image slices with the media-adventitia border that could not be measured reliably by major side branch or signal attenuation >90° were excluded. OCT images were analyzed in

FIGURE 1 OCT Images of SCAD and Nonobstructive CAD, and Comparison of Adventitial VV Volume



Two consecutive optical coherence tomography (OCT) images showed adventitial vasa vasorum (VV) **(arrow)** defined as a microchannel having signal voiding tubular or layer structures in **(A and B)** spontaneous coronary artery dissection (SCAD). After volume rendering, 3-dimensional (3D) OCT image showed the structural pattern of adventitial VV **(red color)** and intramural hematoma **(*)** in **(C)** SCAD. Compared with adventitial vasa vasorum volume (VVV), SCAD patients had higher **(D)** VVV/% plaque volume (PV), **(E)** VVV/PV, and **(F)** VVV/vessel volume.

the disease-free segment adjacent to the intramural hematoma in patients with SCAD and the middle segment of the left anterior descending artery in those with nonobstructive CAD. Plaque volume (PV) was defined as intimal volume plus medial volume. Volume was divided by lesion length to correct for the different lesion length in each patient and described as adjusted volume (cubic millimeters/millimeter). Differences between the groups were tested using the Mann-Whitney *U* test. The study protocol was approved by the institutional review board of the Mayo Clinic, and written consent was obtained from all study subjects.

OCT was performed at median 44 days (interquartile range [IQR]: 14.5 to 446 days) after the first presentation of SCAD. Imaging segment length was comparable in both groups (12.9 mm [IQR: 9.7 to 17.1] vs. 12.2 mm [IQR: 7.7 to 14.0], $p = 0.16$). Patients with SCAD had lower PV (1.18 mm^3/mm [IQR: 0.91 to 1.78] vs. 2.51 mm^3/mm [IQR: 1.76 to 2.97], $p = 0.008$) and higher vasa vasorum volume (VVV) (0.47 mm^3/mm [IQR: 0.32 to 0.56] vs. 0.19 mm^3/mm [IQR: 0.10 to 0.24], $p < 0.001$) than those with nonobstructive CAD. VVV/% PV, VVV/PV, and VVV/vessel volume were higher in patients with SCAD than those with nonobstructive CAD (1.85 [IQR: 1.41 to 3.22] vs. 0.66 [IQR: 0.38 to 1.03], $p < 0.001$; 0.37 [IQR: 0.24 to 0.45] vs. 0.08 [IQR: 0.04 to 0.11], $p < 0.001$; 0.07 [IQR: 0.06 to 0.09] vs. 0.02 [IQR: 0.01 to 0.03], $p < 0.001$, respectively) (**Figures 1D to 1F**).

The present study shows that patients with a history of SCAD have a higher density of coronary adventitial VV in nonculprit segments adjacent to the SCAD region. A previous study found that neoangiogenesis of capillary vessels branching from the VV in the adventitia and leakage of neoangiogenetic capillaries is one mechanism of spontaneous cervical artery dissection (3). In the present study, we made a similar observation of extensive proliferation of adventitial VV in patients with SCAD. This finding supports a common intramural hematoma/atypical dissection predisposition in adventitial VV that extends to patients with SCAD. Extravasation of blood from proliferative adventitial VV may lead to the formation of microhematoma between media and adventitia that could result in coronary dissection. However, the present study does not provide a causal relationship between SCAD and increased VV density, which may be reactive.

In conclusion, the present study demonstrated that the adventitial VV is increased in patients with SCAD and suggested that proliferation of adventitial VV may be linked to development of SCAD in humans. Further studies are needed to determine the causal relationship between VV and SCAD.

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Fusiform Appearance of Myocardial Bridging Detected by OCT

Myocardial bridging (MB) is characterized by epicardial coronary artery tunneling through the myocardium, with angiographic "milking" and an intravascular ultrasound (IVUS) "half-moon" echolucent (1). Optical coherence tomography (OCT), a light-based technique, can provide unprecedented in vivo imaging of coronary vessel wall structure, especially of intima and plaque composition, with a high resolution of 10 μm. So far, there are no data on visualization of MB using OCT.

From November 2013 to July 2014, we prospectively identified 36 patients with angiographically "milking" of the left anterior descending artery (LAD) consistent with the diagnosis of MB. Both OCT and IVUS imaging were performed after patients gave informed consent. OCT was also performed at the most compressed site manually after automatic pullback. In all patients and in all MB segments corresponding to OCT and IVUS imaging, a heterogeneous, generally signal-poor