Observation of an Asymptomatic Dissecting Aortic Aneurysm Using Non-Obstructive Angioscopy
A Novel Method

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Summary
Non-obstructive angioscopy has become a novel method of evaluating atheromatous plaques of the aortic intimal wall. A 77-year-old man with coronary artery disease underwent percutaneous coronary intervention in the left descending artery. We subsequently used non-obstructive angioscopy to identify atheromatous plaques and incidentally diagnosed an aortic dissecting aneurysm. Non-obstructive angioscopy demonstrated a great fissure in severe atheromatous plaques at the entry site of the aortic dissection identified by enhanced computed tomography. This is the first report to describe the aortic intimal findings of an aortic dissecting aneurysm in vivo by using trans-catheter angioscopy.

Key words: Aortic angioscopy, Aortic dissection, Atherosclerotic aorta, Vulnerable plaque

Aortic dissection is a fatal disease that is often found with sudden onset.1,4 Although conventional modalities such as computed tomography (CT), magnetic resonance imaging (MRI), and transesophageal echocardiography (TEE) have been used to diagnose aortic diseases such as aortic dissection, it is difficult to predict the onset of aortic diseases.1,5 The cause of aortic dissection has not been fully elucidated. Non-obstructive angioscopy for the aorta is a new modality that may have higher reliability identifying atherosclerosis of the aortic wall because of its higher spatial resolution compared with CT.1,5,6 Non-obstructive angioscopy is expected to contribute to elucidating the prediction of aortic disease onset.5

Case Report
A 77-year-old man with coronary risk factors including diabetes mellitus, hypertension, dyslipidemia, and smoking was admitted to our hospital with intermittent claudication. Laboratory test results showed that his lipid profile was comparatively well controlled and that his C-reactive protein and D-dimer levels were normal on admission (Table). Coronary angiography detected total occlusion in the mid-left anterior descending artery (LAD), and aortography showed a severe stenotic lesion in the right common iliac artery (CIA), aortic wall irregularity, and dilatation in the infrarenal abdominal aorta. We diagnosed peripheral artery disease with Fontaine classification 2 and performed endovascular therapy (EVT) for the right CIA (Figure 1). His symptoms were relieved after EVT of the right CIA. Later, percutaneous coronary intervention was performed for the occluded lesion of the mid-LAD (Figure 2). Then, we used non-obstructive angioscopy to evaluate coronary and aortic atherosclerosis. Coronary angioscopy showed yellow plaque and red and white thrombi at the occluded site (Figure 2B). Aortic angioscopy showed several features of atheromatous plaques, such as ruptured plaques, red thrombi, and intense yellow plaques throughout the aorta (Figure 3), and a great fissure in the infrarenal abdominal aorta (Figure 3E). Enhanced CT was performed to clarify the atherosclerotic

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changes of the whole aorta after the procedure and revealed a dissecting aortic aneurysm in the infrarenal abdominal aorta, communicating aortic dissection from the infrarenal abdominal aorta to the left CIA, and an entry tear of the aortic dissection above the aortic aneurysm (Figure 4). We identified the site of aortic angioscopy by referencing the height of the vertebral body and the branches of the arteries using fluoroscopy and enhanced CT. The great fissure in the severe atheromatous plaques with aortic angioscopy matched the entry tear of the dissecting aortic aneurysm with enhanced CT (Figure 4). We managed the patient’s blood pressure and lipid status; according to enhanced CT, the aortic aneurysm and dissecting lumen have not progressed for 2 years.
Figure 3. Intense yellow plaques (A, D, E), yellow plaques (B, C, G, H), red thrombi (C-H), plaque rupture (E, G, H), the great fissure (E), and ulceration (F) were observed using aortic angioscopy. We observed severe atheromatous plaques, especially in the infrarenal abdominal aorta (E-H). We defined plaque rupture as the disruption of aortic intima and the protrusion of plaque contents into the vessel lumen.

Figure 4. Enhanced CT indicated the dissecting aortic aneurysm in the infrarenal abdominal aorta. Three-dimensional imaging of the aorta with enhanced CT demonstrated a fissure (red arrow) above the aortic aneurysm. This site was the dissection entry point (red arrow). Angioscopy showed the great fissure (red arrow). This fissure in the atheromatous plaques indicated the tear, which was the dissection entry point. CT indicates computed tomography.

Discussion

Although aortic dissection and ruptured aortic aneurysms can be fatal, even with intensive and surgical care, they can be difficult to predict because, in many cases, they remain silent until fully developed. Previous reports have shown that atherosclerotic ulcers penetrating the internal elastic lamina with hematoma formation within the media of the aortic wall were associated with aortic dissections, however, the detailed pathogenesis...
of aortic dissection remains unclear. In general, CT, MRI, and TEE have been used to diagnose aortic diseases. However, few modalities can fully detect intimal injury or vulnerable plaques in the aorta in vivo. Non-obstructive angioscopy is a useful modality for evaluating atherosclerosis by direct visualization of intracoronary surface morphology.\textsuperscript{22-36} Historically, non-obstructive angioscopy has been developed to observe the coronary arteries. Komatsu, \textit{et al.} reported that the surface of the aorta could be observed by new methods using non-obstructive angioscopy.\textsuperscript{22} Because aortic angioscopy has high spatial resolution and is suitable for observing local lesions, it can reveal details of aortic atherosclerosis that are difficult to observe with conventional CT, MRI, and TEE.\textsuperscript{25} In this case, we used aortic angioscopy with a system similar to that used in previous studies to identify aortic atheromatous plaques.\textsuperscript{21} Aortic angioscopy showed many ruptured plaques, red thrombi, and yellow plaques throughout the aorta (Figure 3). Furthermore, aortic angioscopy demonstrated a great fissure in the severe atheromatous plaques around the entry tear of the dissecting aortic aneurysm (Figure 4). Enhanced CT was able to show atherosclerotic lesions with aortic wall thickening and an entry tear of the dissecting aortic aneurysm; however, it could not detect the existence of thrombi or ruptured plaques (Figure 3).

Aortic angioscopy visualized the vulnerable aortic plaques more clearly compared with enhanced CT. These aortic angioscopic findings around the entry tear suggested that severe atheromatous plaques and penetrating atherosclerotic ulcers might have contributed to the aortic dissection. Aortic angioscopy may be helpful not only for diagnosing aortic disease but also for clarifying the mechanisms of aortic diseases. To our knowledge, this is the first report to use trans-catheter angioscopy to describe the aortic intimal findings of a patient with a dissecting aortic aneurysm in vivo.

Aortic angioscopy has a few limitations. First, direct relationships between atheromatous plaque morphologies detected by aortic angioscopy and future aortic events remain undetermined. Long-term follow-up data are needed. Second, using aortic angioscopy, it was difficult to evaluate the global image of the aorta, such as the diameter of the aortic aneurysm and the existence of the false lumen for aortic dissection, because only the vascular lumen surface was observed.\textsuperscript{25} Therefore, it was necessary to use enhanced CT to examine the global image of the aorta. Third, aortic angioscopy is an invasive examination, but careful observation with aortic angioscopy causes few serious complications if the examiner is trained.\textsuperscript{25,35}

\textbf{Conclusions}

Non-obstructive angioscopy may be useful for evaluating local atherosclerosis of the aorta and clarifying the pathophysiology of aortic diseases, thereby leading to improvements in aortic event risk stratification.

\textbf{Disclosures}

\textbf{Conflicts of interest:} The authors have no financial conflicts of interest to disclose.

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