Backyards of Chronic Total Occlusion
Scenery Revealed Through Angioscope

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Chronic total occlusion (CTO) remains a challenging lesion subset in percutaneous coronary intervention and endovascular treatment because of low initial procedural success rates and high rates of restenosis at the chronic stage. There are only a few reports of human pathologic specimens of CTO in the literature. Angioscopy has been reported to be useful for the direct visualization of thrombus and allows for characterization of the vessel wall from inside, but we cannot observe the distal side of CTO in coronary arteries. Here we report an evaluation of the distal side of CTO of the superficial femoral artery (SFA) via a retrograde approach with angioscopy.

Case 1
A 71-year-old man with hypertension, dyslipidemia, and type 2 diabetes mellitus noticed intermittent claudication in both legs in 2003. He received endovascular treatment of the left iliac artery in 2003 and that of the right iliac artery in 2008. The symptom, however, recurred in 2010, and medical treatment failed to improve it. He received another endovascular treatment for the right SFA. Control angiography revealed a short total occlusion in the right SFA (Figure 1A and Movies I and II in the online-only Data Supplement). We decided to approach the CTO both antegradely and retrogradely according to the previous report. Under an adequate anticoagulation with heparin, we observed proximal and distal sides of CTO on the distal side of the CTO, whereas it showed no thrombus in the proximal side. We implanted stents, and the angiography thereafter showed no sign of thromboembolism.

Case 2
A 76-year-old woman with hypertension, dyslipidemia, and chronic atrial fibrillation noticed intermittent claudication in both legs after a 100-meter walk in 2008. Medical treatment was started without effect, leaving progression of the leg pain for a 40-meter walk. A diagnostic angiography revealed a long total occlusion of the left SFA (Figure 2A and Movie VI in the online-only Data Supplement) in January 2013. One month later, an angioscopic examination was performed as described above before conducting endovascular treatment for the lesion. It showed the presence of white and red thrombi over the dark yellow plaques (Figure 2B and 2C and Movies VII and VIII in the online-only Data Supplement) on the distal side of the CTO, whereas it showed no thrombus in the proximal side. We implanted stents in the lesion, and the postprocedural angiography showed no sign of thromboembolism.

Discussion
The histopathologic process of CTO formation has not been well understood. It is generally considered that CTO starts with occlusion of the artery with thrombus, followed by replacement with collagen formation and deposition of calcium. Although this theory is widely believed, it is difficult to prove in vivo, and the previous histologic study reported no fresh thrombus in CTO lesions. Angioscopy enables direct visualization of the lumen, which makes it useful for the diagnosis of thrombus, but it cannot reach the distal side of CTO lesions in coronary arteries. Therefore, we decided to examine it in the femoral artery of patients with arteriosclerosis obliterans, and to our knowledge, this is the first reported angioscopic finding of the distal side of CTO lesions. In both of our cases, multiple thrombi of variable nature were identified with patchy distribution on the distal side, but not on the proximal side, of the CTO lesions. Those thrombi could not be identified with angiography. There was no coagulation disorder in these patients. Our observations support an idea that one mechanism of formation of a long CTO lesion can be the result of a distal extension of the thrombus that started from the initial site of occlusion. The presence of red and mixed thrombi on the distal side of our CTO lesions suggests that the combined use of anticoagulation with antiplatelet agents may be more effective to minimize the extending growth of the CTO lesion.

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Disclosures

None.

References


**Figure 1.** Images of peripheral arterial angiogram and angioscope of pre-endovascular treatment in case 1. Control angiography (A) showed that the superficial femoral artery (SFA) was occluded immediately after branching of the deep femoral artery (DFA). Collateral circulation from the DFA irrigated the SFA distal to the occlusion, and its filling with contrast media was observed. The red 2-way arrow indicates the range of chronic total occlusion of the SFA. Angioscopic images (B through D) captured from Movies III through V in the online-only Data Supplement, respectively, were acquired at the sites marked by solid arrows in A, and thrombi are indicated by hollow arrows. Variable thrombi (B, a red thrombus partly covered by white thrombi; C, a white thrombus; D, mixed thrombus) could be identified over the light yellow plaques.

**Figure 2.** Images of peripheral arterial angiogram and angioscope of pre-endovascular treatment in case 2. Diagnostic angiography (A) showed that the superficial femoral artery (SFA) was occluded immediately after branching of deep femoral artery (DFA), and the distal side of the occlusion was contrast filled by collateral flow from the DFA. The red 2-way arrow indicates the range of chronic total occlusion of the SFA. Angioscopic images (B and C) captured from Movies VII and VIII in the online-only Data Supplement, respectively, were acquired at the sites indicated by solid arrows in A, and thrombi are indicated by hollow arrows. Variable thrombi (B, white thrombi; C, red thrombus attached with a flapping white thrombus) could be identified over the dark yellow plaques.
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