Letter to the Editor

Fractional flow reserve-guided endovascular therapy for common iliac artery stenosis; a comparison with the exercise ankle brachial index: A case report

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A 68-year-old man with hypertension and dyslipidemia was referred to our hospital following an episode of intermittent claudication of the left lower extremity. His ankle brachial index (ABI) at rest was normal (left/right = 0.95/1.08). To differentiate arterial claudication from non-arterial claudication, the post-exercise ABI was measured. After 3 min of treadmill exercise (2.4 km/h, 12% grade), a cramping pain occurred in the left leg. The left ABI significantly decreased to 0.49, but the right ABI remained normal. Computed tomography angiography (CTA) revealed intermediate stenosis with a non-calcified plaque in the left common iliac artery (Fig. 1a). The patient was prescribed 30 min of exercise training, three times per week, and 100 mg of cilostazol per day for 3 months; however, he was unable to perform normal work. Therefore, an endovascular treatment was performed. Aortography confirmed the stenosis in the left common iliac artery found in the CTA (Fig. 1b). To evaluate the hemodynamic significance of the stenosis, simultaneous intra-arterial pressure measurements were recorded at the proximal and distal sites of the stenosis with a 0.014-in pressure wire (PrimeWire, Volcano, San Diego, California). At baseline, the ratio of distal to proximal peak systolic pressure was 0.89 (Fig. 1c). After intra-arterial administration of 200 μg of adenosine 5-triphosphate (ATP), the ratio of distal to proximal peak systolic pressure fell to 0.53 (Fig. 1d). After a stent (Epic 10 mm × 80 mm, Boston Scientific, Natick, MA, Fig. 2a) was implanted with intravascular ultrasound guidance, the ratio of the distal to proximal peak systolic pressure at hyperemia induced by 200 μg of ATP was unchanged from baseline (Fig. 2b, c). A post procedural treadmill exercise test (3.2 km/h, 12% grade, 5 min) did not cause a decrease in the ABI (left/right = 0.96/1.07), and the claudication symptoms disappeared.

The resting ABI provides objective data for establishing lower extremity peripheral artery disease (PAD) [1]. However, in our case, some patients with claudication may have no pressure decrease at rest, despite the presence of physiologically obstructive PAD. Although measuring ABI after the treadmill exercise is helpful for detecting functional abnormalities [2], there are limitations to the use of treadmill testing for patients with exercise-limiting comorbidities, including severe aortic stenosis, congestive heart failure, chronic obstructive pulmonary disease, and uncontrolled hypertension [3]. Imaging tests are useful for diagnosing PAD, and angiography is the gold standard for identifying the anatomical location and severity of stenosis. However, imaging tests, including angiography, cannot provide sufficient information for determining whether the stenosis causes a physiological abnormality. Thus, in a patient with a normal resting ABI, it is difficult to determine the indication and endpoint for endovascular therapy solely from image findings. A reliable index is needed that can assess functional abnormalities in PAD, like the myocardial fractional flow reserve (FFR) in coronary artery disease [4]. Our case showed that the ratio of distal to proximal peak systolic pressure after intra-arterial ATP administration was well correlated to the post exercise ABI. Therefore, a simultaneous intra-arterial pressure assessment across a stenosis with a pressure wire under ATP administration (i.e., a peripheral FFR) can be a useful tool in physiology-based PAD therapy.

Conflict of interest

All authors declare no conflicts of interest from financial support or sponsors.

References

Fig. 1. Angiography and intra-arterial pressure assessments across a stenosis with a pressure wire before endovascular therapy. (a) Computed tomography angiography shows an intermediate stenosis with non-calcified atherosclerosis in the left common iliac artery. (b) Angiography shows the stenosis in the left common iliac artery; a pressure wire (with sheath) was inserted to perform simultaneous pressure measurements at the proximal and distal sites of the stenosis. (c) Simultaneous pressure recordings at baseline. Yellow: pressure measured proximal to the stenosis. Red: pressure measured distal to the stenosis. (d) Simultaneous pressure recordings during hyperemia induced with intra-arterial administration of 200 μg of ATP. Yellow: pressure measured proximal to the stenosis. Red: pressure measured distal to the stenosis.

Fig. 2. Angiography and intra-arterial pressure assessments across a stenosis with a pressure wire after endovascular therapy. (a) Angiography after stent implantation (line: 10 mm × 80 mm). (b) Simultaneous proximal and distal pressure recordings at baseline. Yellow: pressure measured proximal to the stent. Red: pressure measured distal to the stent. (c) Simultaneous proximal and distal pressure recordings during hyperemia induced by intra-arterial administration of 200 μg of ATP. Yellow: pressure measured proximal to the stent. Red: pressure measured distal to the stent.
