


Doppler ultrasound diagnosis of transient leg malperfusion caused by dynamic obstruction in a patient with chronic aortic dissection

Tsuyoshi Yoshimuta MD, PhD^{1,2}  | Akira Tsuneto MD, PhD¹ | Toshiya Okajima MD, PhD³ | Hiroshi Tanaka MD, PhD⁴ | Takako Minami MD, PhD¹ | Masakazu Yamagishi MD, PhD⁵ | Satoshi Ikeda MD, PhD¹ | Hiroaki Kawano MD, PhD¹ | Koji Maemura MD, PhD¹

¹Department of Cardiovascular Medicine, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan

²Department of Cardiovascular Medicine, National Cerebral and Cardiovascular Center, Osaka, Japan

³Division of Cardiology, Kyoritsu Hospital, Hyogo, Japan

⁴Department of Cardiovascular Surgery, National Cerebral and Cardiovascular Center, Osaka, Japan

⁵Division of Cardiovascular Medicine, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan

Correspondence

Tsuyoshi Yoshimuta, MD, PhD, Department of Cardiovascular Medicine, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan.
Email: thyoshimu55@nagasaki-u.ac.jp

Leg malperfusion caused by dynamic obstruction is a serious complication of aortic dissection. A diagnosis of the malperfusion is difficult because it is made mainly on the basis of nonspecific symptoms such as intermittent claudication and numbness on walking. In the present study, we reported on a case of a 51-year-old man with leg malperfusion in chronic aortic dissection diagnosed by Doppler ultrasound. The combination of bisferious and dampened velocity waveform changes after walking may lead us to suspect a leg malperfusion caused by dynamic obstruction.

KEYWORDS

Doppler ultrasound, dynamic obstruction, leg malperfusion

1 | CASE REPORT

A 51-year-old man was admitted to our hospital with a sudden onset of severe chest pain. Contrast-enhanced computed tomography (CT) showed acute type B aortic dissection with a thrombosed false lumen in the ascending aorta and partially thrombosed false lumen in the descending aorta. In addition, there was an intimal flap extending from the ascending aorta to the right common iliac artery. Because there was no evidence of obstruction or severe compression of the true lumen by the false lumen, he was treated with medication. Several months later, he complained of worsening left lower limb fatigue on walking. The ankle-brachial

pressure index was >0.9 in both legs at rest. Contrast-enhanced CT again demonstrated no evidence of obstruction or severe narrowing of the true lumen (Figure 1). Therefore, he underwent a walking test (an incline of 5% and a speed of 2.4 km/h) to differentiate vascular claudication from neurogenic claudication.¹ The test was stopped after 4 minutes and 17 seconds (a distance of 171.1 m) at a maximal blood pressure of 140/82 mm Hg because he complained of cramp in his left calf. Under these conditions, Doppler ultrasound (US) of the left common femoral artery, which was supplied via true lumen, showed a bisferious velocity waveform with dampened early and late systolic components and absent diastolic components (Figure 2A, red and yellow arrows).

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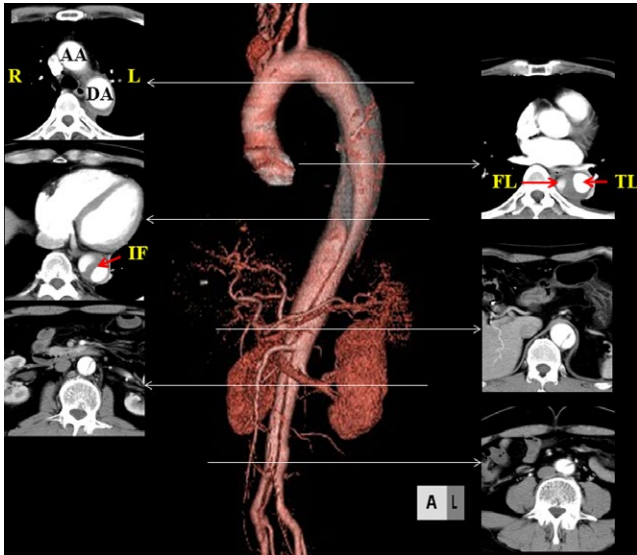


FIGURE 1 Contrast-enhanced computed tomography shows aortic dissection with a partially thrombosed false lumen in the descending aorta and an intimal flap extending from the descending thoracic aorta to the right common iliac artery. Center: Image obtained by 3-dimensional reconstruction of computed tomography data. Left and Right: Early phase axial images. Note that there is no evidence of obstruction or severe compression of the true lumen by the false lumen. AA, Ascending aorta; DA, Descending aorta; FL, False lumen; IF, Intimal flap; L, Left; R, Right; TL, True lumen

Ten minutes later, repeat Doppler US of the left common femoral artery showed a normal waveform after complete resolution of his symptoms with a blood pressure of 108/54 mm Hg (Figure 2B). Subsequently, he underwent open surgical aneurysm repair with a Y-graft and his symptoms on walking resolved.

2 | DISCUSSION

Organ malperfusion resulting from aortic dissection is a serious complication with a poor outcome if it is not appropriately

diagnosed.^{2,3} The malperfusion has two main causative factors, which are classified as static and dynamic obstruction.⁴ Malperfusion caused by static obstruction occurs when the dissection flap occludes or enters the origin of a branch vessel. In patients with static obstruction, CT often demonstrates a true lumen is severely compressed by false lumen in either the thoracic or abdominal aorta.^{4,5} On the other hand, a clinical diagnosis of malperfusion by dynamic obstruction can only be made on the basis of nonspecific symptoms such as intermittent claudication and numbness on walking, because CT shows that the true lumen has an adequate diameter. Malperfusion cause by dynamic obstruction is thought to occur when the dissection flap within the aortic lumen moves toward the true lumen in response to changes in blood pressure, leading to organ ischemia and dysfunction.^{4,6} However, the relationship between malperfusion cause by dynamic obstruction and blood pressure is complicated. According to experimental study in a dissection model, the true lumen collapse is induced by an increase in the size of an entry tear, a decrease in the false-lumen outflow caused by occluding the false-lumen branch vessels, or an increase in the true-lumen outflow created by lowering the peripheral resistance in true-lumen branch vessels.⁶ As shown in Figure 2A, an interesting aspect of our case was a finding that systolic velocity waveform had two components with the diminished early and late systolic velocity waveform after walking. The finding may be caused by a mechanism that true lumen was severely compressed by the false lumen, when blood pressure of false lumen was much higher than that of true lumen after walking. To our knowledge, there has been no previous report of bisferious and dampened velocity waveform changes in patients with leg malperfusion due to dynamic obstruction after walking, while there have been some reports of organ malperfusion due to static obstruction.⁷⁻⁹ Performing Doppler US after walking can clearly demonstrate the pathophysiologic mechanism of leg malperfusion due to dynamic obstruction in patients with chronic aortic dissection by showing changes of the Doppler velocity waveform, although further prospective investigation should be performed to confirm the sensitivity and specificity.

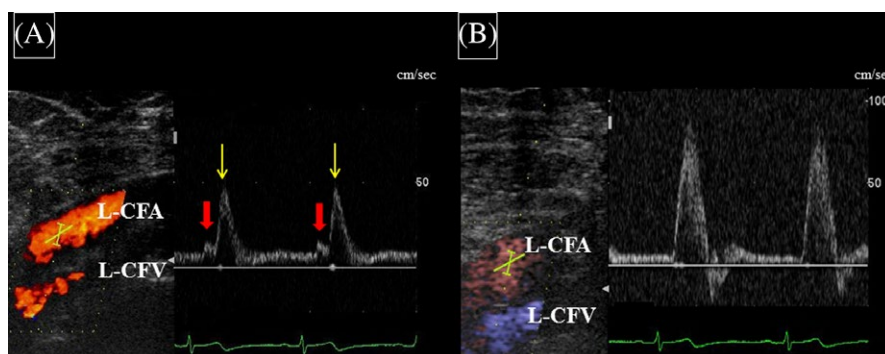


FIGURE 2 Doppler US shows exercise-induced changes of the Doppler velocity waveform in the left common femoral artery (CFA). A, Doppler US shows bisferious velocity waveforms with dampened early and late systolic components (red and yellow arrows) and absent diastolic component immediately after walking. B, Ten minutes later, Doppler US shows normal Doppler velocity waveforms after complete resolution of his symptoms. L-CFA, Left common femoral artery, L-CFV, Left common femoral vein

ORCID

Tsuyoshi Yoshimuta  <https://orcid.org/0000-0003-4694-5547>

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