A 65-year-old man was admitted to our hospital because of a transient cerebral ischemic attack. Cranial CT and MRI showed no specific abnormality. Carotid imaging was performed with a newly developed convergent color Doppler (CCD), which images information on both flow velocity and Doppler signal energy simultaneously. These correspond to frequency shift and integral of Doppler frequency-power spectrum, respectively. In CCD, because the flow including high-velocity component is colored, turbulent or vortex flow was clearly distinguished from laminar flow with physiological flow velocity. The CCD flow image revealed hollowing at the inner surface of the carotid wall, depicted as blue area (arrow). This was considered as reflecting a vortex flow at the site of ulcer lesion. An accelerated poststenotic flow was demonstrated as a red area (Figure, top). Two-dimensional echo could depict a clear stenotic lesion but no definite ulceration. Carotid artery angiography confirmed the ulceration and stenosis at the same site (Figure, lower left) despite no observation of the lesion on MR angiography. On the basis of the CCD information, endarterectomy was performed, and the ulcer lesion with a small thrombus was confirmed pathomorphologically (Figure, lower right). It is likely that a microthrombus formed in this ulceration, causing a transient ischemic attack.

This is the first report of image diagnosis of a definite ulcer lesion. From this case study, CCD was thought to be a noninvasive and feasible diagnostic modality for diagnosing atherosclerotic lesions by visualizing flow conditions in significant stenosis and ulceration. The information obtained by this technique could be of great clinical benefit for detecting the atherosclerotic lesions in carotid artery.
CCD carotid image (top), carotid artery angiogram (lower left), and pathological sample of lesion obtained by endarterectomy (lower right). CCD revealed flow image hollowing at inner surface of carotid wall, depicted as blue area (arrow). An accelerated poststenotic flow was imaged as red (upper area). Carotid artery angiography showed ulceration (arrow) and stenosis at site corresponding to that detected by CCD (lower left). Pathological sample after angiography and endarterectomy confirmed ulcer lesion (lower right).
Ulceration and Stenosis of Internal Carotid Artery Imaged by Convergent Color Doppler
Katsufumi Mizushige, Hideo Ohyama, Masaya Kitadai, Shoichi Senda and Hirohide Matsuo

_Circulation_. 1999;100:e82-e83
doi: 10.1161/01.CIR.100.17.e82

_Circulation_ is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1999 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/100/17/e82

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in _Circulation_ can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to _Circulation_ is online at:
http://circ.ahajournals.org//subscriptions/